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The Electro-Metallurgical Establishment at Sestri-Levante for the Extraction of Copper.

The following is a general description of the establishment shown in our illustration, and of the processes carried on therein. The establishment is situated in the valley of the Bargonasco, on the left bank of the torrent of that name, is a confluent of the Petronia, which enters the sea near Sestri-Levante. A road of about seven kilometers connects the works with the railway station of Sestri-Levante. The water necessary for the motive power is furnished by the Bargonasco; and there has been constructed, in order to insure a fall of 60 meters' height, a canal which, following the sinuosities of the mountain, is 1,300 meters long, of which 300 meters are in tunnels. This canal conducts the water to the turbines which drive the dynamos, producing there an effective force of about 300 horse-power. At present only three turbines are in use, of 175 horse-power in all, and of this amount only a portion is used, for the dynamo, the ventilator, the grinding mill, the pumps, etc. The ores are furnished by the mines of Libiola, Galinaria, Monteloreto, and Bargone, and partly by the mines of Montecatini, but only the richest of the ores from the latter mine are used. The ores vary in richness according to their place of origin, containing from fifteen per cent. to fifty per cent. of copper.

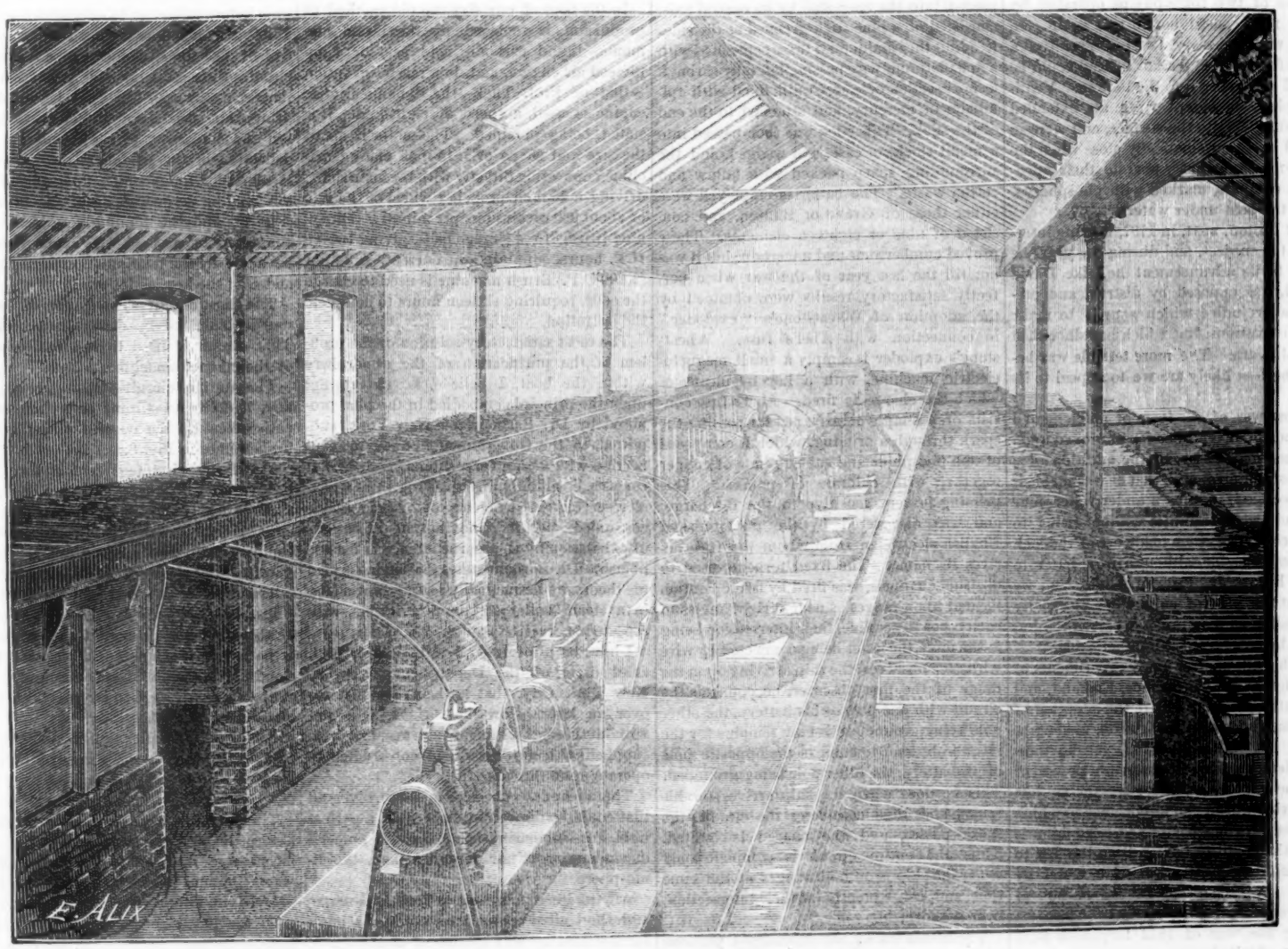
The twenty dynamo-electric machines are arranged in two batteries of ten machines each. Each dynamo is connected with twelve vats, arranged in tension. Each vat is charged with fifteen anodes and sixteen cathodes, placed at five centimeters apart. The dynamo—Siemens & Halske's model, C 18—gives a current of 240 amperes, with a difference of potential of fifteen volts, when the resistance of the exterior circuit is 0.0625 ohms and the speed of rotation 950 revolutions per minute. The $12 \times 240 = 2880$ amperes of current which traverse the bath correspond approximately to a deposit of eighty-two kilogrammes of copper per twenty-four hours per machine.

In taking a general view of the process we may divide the treatment into three operations:

1. The preliminary smelting of the ore into ingots, which is the sole part of the process only applicable in places where water supply is abundant. At present, 3,000 horse-power can be depended upon from this source.

3. The secondary chemical operations for the utilization of the waste products do not form any specialty of this method of procedure, and may be varied according to special surrounding circumstances.

We hope to recur to this subject at a future time, and to discuss especially a question of great interest to practical men, viz., the separation by electrolysis of the silver and lead from galena.—*La Lumiere Electrique.*



Electro Metallurgical Establishment for the Extraction of Copper.

—— The city of Chihuahua, in Mexico, is now lit with the electric light.

Electricity Under the Sea.

By John W. Beane.

So important a part has electricity played in the solution of many of the problems of submarine operations, and so numerous are the apparently insurmountable obstacles which in late years have been overcome by the aid of electrical appliances, that, indeed, I do not consider it the least improbable that this century should practically realize many of what are now considered simply Jules Verne's fancies as fascinatingly described in his story of "20,000 Leagues Under the Sea." Captain Nemo and his submarine ship may not prove such myths, after all! This subject has always been one of weird and absorbing interest, and among its devotees boasts some of the most noted inventive geniuses of our age. Like aeronautics, it counts its martyrs by the score.

David Bushnell, of Connecticut, in 1771, invented the first submarine boat of which there is any accurate record; and, after years spent in devotion to this subject, died under an assumed name, a bitterly-disappointed man, and not until his will was opened was his identity disclosed to those among whom

he had settled in Georgia, upon his return from the Continent, after a vain endeavor to interest some of the maritime nations of Europe in his projects of submarine warfare.

An account of this boat may be found in the "Proceedings of the American Philosophical Society" for June 8, 1778, and to-day we cannot but commend the ingenuity displayed in its details. In connection with this boat he invented a torpedo, which was to be attached to the bottom of the vessel to be destroyed by a wood-screw, manipulated from the interior and fired by clockwork at the expiration of a prescribed interval of time, the firing arrangement being constructed on the principle of an old-fashioned flint gun lock.

I will add a description of this vessel, as it embodies the general features of a majority of the submarine boats subsequently invented.

It is best described as of the shape of two upper tortoise shells, joined at their edges, and floating with its longer axis vertical. The interior was sufficiently large to accommodate one operator with enough air to sustain proper respiration for thirty minutes without renewal. Motion laterally was attained by means of a propeller, turned by hand or foot, and a rudder guided her transversely; a similar propeller was used to regulate her distance below the surface, and was placed at the top of the boat. The admission of water to a tank at the bottom caused her to descend below the surface, and its ejection, by means of two force-pumps operated by hand or foot, caused her to rise again. In case it was necessary to rise instantly, a weight of about 200 pounds of lead could be detached and lowered to the bottom. Ventilating pipes to admit fresh air extended about twenty feet to the surface, and were so arranged as to automatically close when the water came dangerously near to their openings. A compass, marked with phosphorus, directed the boat under water.

Robert Fulton, next, in 1797, became interested in the subject, and during the years he devoted to its advancement he, like David Bushnell, was opposed by distrust and prejudice—a prejudice which sought to make warfare chivalrous, but which has since died a natural death. The more terrible war becomes, the less likely are we to appeal to its decision.

His boat was of the form of an elongated ovoid, and the inventor so far improved upon that of his predecessor, by the addition of a cylinder of compressed air that he was enabled, on one occasion, to remain under water four hours and twenty minutes without rising to the surface. His system made use of the lock to fire the magazine, although in a letter to William Brents, Jr., Esq., of Aquia, Va., we learn that the idea of employing electricity for exploding sunken mines occurred to him, and that he considered it impracticable.

Though Fulton, after many experiments of more or less success in France, England, and this country, failed to secure the adoption of his system, and steam navigation, at length, claiming his entire attention, yet he thoroughly demonstrated the terrific power of submarine explosions, and gave the subject of submarine warfare an importance to which it had not previously attained. To him is also due the credit of having been the first to accomplish the destruction of a vessel by torpedo. This occurred in the harbor of Brest, France, in 1801.

During the war of 1812 torpedoes were used, but with little success.

In 1829, Col. Colt, later the inventor of the "revolver," then a very young man, commenced a series of experiments upon submarine mines, which he continued up to 1845 About the year 1842, he conducted several successful public experiments, the most important of which took place upon the Potomac River, under the auspices of the Government, when he blew up a schooner under way, sailing at the rate of about five knots per hour.

Unfortunately, no official records can be found at either the War or Navy Departments of the methods employed in these later experiments. It is considered probable, however, that his torpedoes were connected by insulated wires with each other, in groups, and with the battery, and his idea was either to compel a vessel to tell her proximity to the mine by telegraph as she touched certain parts of the apparatus; or, by the vessel's contact, close the circuit and ignite the fuse. In the cables employed by him beeswax and asphaltum were used as the insulating materials. Gutta-percha was not then known.

Col. Colt seems to have been the first to make use of the electric current in connection with submarine operations, as he was the first to conceive the idea of using the electric spark to ignite the mine.

The Russians, during the Crimean war, made extensive use of the fixed or sunken electric torpedo as a part of their system of harbor defence, and their employment exerted a marked restraint upon naval operations.

It was not, however, till the war of the Rebellion that submarine warfare became an art, and when we recall the long list of noble ships destroyed by that terrible engine of destruction, the torpedo, its immense influence upon modern naval warfare will be appreciated.

In the South a corps was formed, called the "Confederate Submarine Battery Service." Skilled labor was imported, and great improvements were made in the general system.

The electric torpedo used consisted of a magazine, shaped like an ordinary can buoy, formed of riveted wrought iron plates, and charged with rifle powder. The fuse, which passed into the magazine by its central axis, consisted of a pine stick grooved at the sides to admit the conductors; these connected with a fine platinum wire passing laterally through a short section of goose-quill filled with fulminate of mercury, and attached to the end of the stick. This stick was then passed into a metal stock, or case, and wedged, and the surrounding space packed with tallow and cotton waste. The batteries employed were either those of Grove or Bunsen, and consisted of nine or eighteen elements. These proved cumbersome and uncertain; but it was not till the last year of the war when perfectly satisfactory results were obtained by the adoption of Wheatstone's "exploder" in connection with Abel's fuse. Wheatstone's exploder is simply a small magneto-electric machine, with a key by means of which the charge is fired. Abel's fuse consists of a simple contrivance for passing the spark through a priming, which is composed of sub-phosphide and sub-sulphide of copper together with chlorate of potassa. This priming is very sensitive to the discharge, and was discovered by the distinguished English electrician from whom the fuse derives its name. The fixed torpedo, used to obstruct channels, was fired by two operators located upon ranges as near at right angles to each other as possible, their intersection being at the mine, the latter being connected by wire with each observer; the ship arriving upon the range of the first observer, he connects the circuit with one pole of his battery, the other pole being grounded; it now remains for the second observer to connect the opposite pole of his battery, the other pole being grounded. This he does when the ship arrives on his range, and thus completes the circuit, the spark passes, and the charge is ignited. Thus the entire circuit is complete only when the ship is on both ranges at the same time, and, consequently, at their intersection, over the torpedo.

The insulation of the submerged portions of the wire consisted of two thicknesses of gutta-percha, with a wrapping of spun-yarn. Sections of chain cable were lashed to them to prevent their easy discovery in dragging. Defective insulation was the cause of much uncertainty, and, in fact, the failure of an attempt to explode a torpedo, over which the "New Ironsides" lay for a full hour, off Charleston, was afterwards discovered to be due to defective insulation in the conducting wires.

Among the numerous forms of fuse invented to be fired by electricity, that of Col. Scholl, an Austrian army officer, is worthy of mention. In it the spark is passed through gun cotton imbedded in the fuse. Another fuse, noted in its time, is that of Statham; it is constructed upon the principle that when a copper wire has been covered for some time with vulcanized gutta-percha, the interior of the tube, on withdrawing the wire, remains covered with a thin layer of sulphide of copper, which is a moderately good conductor of electricity. If a section of the tube be placed between the extremities of two conducting wires, the current passes through the sulphide of copper, but, meeting with considerable resistance, it ignites the sulphide. In Statham's fuse the tube is filled with fulminate of mercury, rubbed up with gum water, dusted with mealed powder and dried.

The fuse adopted by the Russians in some of their electric torpedoes made use of carbon points with a separation of about $\frac{1}{100}$ inch; the points were coated with sulphide of antimony, and surrounded by fine rifle powder.

Previous to the invention of the magneto-electric exploder for firing mines in branch circuits, recourse was had, in many countries, to statical electricity for a charge of sufficient intensity. Ebonite plate machines were the most convenient and successful; in them ebonite replaced the glass of a plate machine, a condenser being added to concentrate the charge.

Of late years many improvements have been made in the details of submarine boats, both in this and foreign countries, particularly in the matters of motive power, purification of the atmosphere of the interior, and illumination.

In the boat of our day the old method of propulsion is replaced by the liquid ammonia, liquid carbonic acid gas, or compressed air engine, and, in a recent invention—that of Prof. Tuck—the dynamo electric engine is used, a speed of eight knots, it is stated, being obtained. The motor is about the size and shape of a 15-inch plating machine, connecting directly with the main shaft, driving a 20-inch propeller wheel at the rate of about 900 revolutions per minute. Thirty-nine Brush No. 4 storage cells, giving twelve H.P. hours, supplying the current. A 3 light (2,000 C.P.) Brush machine is used to charge the cells, requiring sixteen hours to complete the operation.

The most satisfactory solution of the problem of the purification of the atmosphere within the boat, I believe, is that resting upon the principle embodied in the plan proposed by Dr. Barbour, of New York, submitted to the Government in 1869, in connection with a plan for a submarine boat. It consists, essentially, in supplying from a metal reservoir the deficiency of oxygen as it is consumed, and in removing the impurities of exhalation by an absorbent, such as caustic potash. Dr. Barbour states that he has tested his theory by hermetically sealing himself up in a steam boiler for hours at a time, with repeated success.

I have been informed by Mr. A. Fairchild, chief diver of the Department of Docks, New York City, that he has remained for over an hour below the surface, as a test, without the slightest inconvenience, in a dress supplied with an attachment constructed to operate upon the same theory.

The incandescent electric lamp gives all that could be desired in the way of a perfect light for submarine boats, as it is no wise dependent upon, nor does it vitiate, the atmosphere.

All the great maritime nations of Europe, and the United States, have national schools for instruction and experiment in the art of submarine warfare, and their ships of war are equipped with an armament of torpedoes.

The ships of the United States Navy are supplied with two kinds of torpedoes, spar and towing—the latter being fired by percussion, the former, by electricity. The spar torpedo is fired from the extremity of a spar, or boom, rigged out from the side of the ship and dipping under water to a depth of about ten or fifteen feet. The permanent conducting wires, running from the battery along the rail of the ship, consist of kerite-covered wires of an external diameter of 0.25 inch; the wire cables employed to connect the terminals of the permanent wires with the torpedoes are made of seven strands of No. 22 B.W.G. copper wire, coated with tin and covered with successive layers of pure rubber, semi-vulcanized rubber, and vulcanized rubber, rubber tape, and jute braiding, in the order named. The total diameter of the cable is 0 33 inch. This cable has a resistance of eleven ohms per nautical mile, and a tensile strength of 525 pounds. Its length is sixty feet. The fuse used is essentially a platinum-silver wire bridge between the ends of two copper conductors. This bridge passes through a priming of gun-cotton. Its resistance, when cold, is about 0.42 ohm, and 0.80 ohm at the firing point of gun-cotton (500° F). The strength of current required for ignition is about 0.6 weber.

Farmer's dynamo-electric machine is used as the exploder, and two sizes are furnished, respectively for ships' and boats' use.

The large machine, pattern *A*, has an E. M. F. of about 16 volts, and an internal resistance of 5 ohms; three or four turns of the crank only, are necessary to generate sufficient current to explode the fuse, and it is capable of firing from 20 to 25 fuses arranged in series, or from 5 to 6, arranged in branch circuit, or through a resistance of 20 ohms: it weighs about 116 pounds.

The smaller pattern, *C*, has an E. M. F. of about 8 volts, and an internal resistance of 5 volts. It will fire from 8 to 10 fuses in series. Its weight is about 40 pounds. In connection with the machine are the "firing key" and "switches."

The firing key gives a convenient method of testing the fuse and fuse circuit at any time before firing, as, in connection with the key is a galvanometer and extra resistance coil of 200 ohms, which can be thrown into circuit, thus reducing the strength of current sent through the fuse below that of firing, but permitting sufficient to pass to test the continuity of the circuit and give a deflection of the galvanometer. When the terminals of the machine are connected with the binding screws, *B, B*, of the firing key (Fig. 1), and the binding screws, *T, T*, are connected by a short wire connections may be made by the manipulation of the keys *T* and *F* of the key, as follows:

The short circuit—The course of the current is indicated by dotted lines in Fig. 1. This circuit is used to test the operation of the magneto-machine.

The testing circuit—Upon pressing the key, *T*, the short circuit is broken, and the path taken by the current is indicated by broken lines in Fig. 2.

The firing circuit—When *F* and *T* are pressed the course is as indicated in Fig. 3.

After leaving *T*, the current branches to either side of the ship and passes along the conductors to the torpedo spars, four in number—two forward and two aft; at the intersections at the ship's sides, the switches (Figs. 4 and 5) are placed, and the method of throwing one or both torpedoes on one or both sides into action will be readily understood by inspection of the diagrams. Earth connections are made to the sheathing copper on the bottom of the ship.

By far the most ingenious among the many appliances, however, for destroying an enemy's ship is what is termed the "automovable" torpedo.

This is simply a sub-marine boat carrying a torpedo at its forward extremity, and in its passage from shore to ship, under the water, its movements are directed by an operator on land. It carries no crew.

Of the noted automovable torpedoes, that invented about 1875, by Mr. W. S. Sims, of New Jersey, holds a prominent place.

The hull is made of sheet copper, and is cigar-shaped; its length is 28 feet, and its maximum breadth 18 inches. It is divided into four compartments; the forward compartment having capacity for about 200 pounds of dynamite; on the extreme forward end is affixed a solid prow.

The second compartment is simply an air space for buoyancy.

The third compartment contains the cable, which leads to the shore to conduct the current of electricity, by means of which the vessel is operated; it is paid out from the chamber as the torpedo leaves the shore, unreeling as she goes. This cable has two conducting wires, separately insulated, one for the steering relay and the other for the electric motor. The conductor for the steer-

ing current is the central wire, and is 0.053 inch in diameter. It is insulated with kerite to a diameter of 0 118 inch and covered with kerite tape to a diameter of 0.14 inch. The outer wires, 12 in number, and 0.042 inches in diameter (No. 19 B.W.G.), together form the motor conductor. These are insulated with kerite to a diameter of 0.34 inch with kerite tape to a total diameter of 0.42 inch. A long pipe guides it clear of the propeller as it runs out of the cable chamber.

The fourth compartment is made up of three sections. The rear section containing the steering gear and relay; the next section forward, the motor and the forward section of the fourth compartment being an air space to add buoyancy.

The rudder is placed on top, and the rudder-post passes through to the inside. At its end is a circular yoke; iron rods, running forward, connected with the yoke and terminating in the armatures of two large electromagnets, regulate the movement of the rudder. When the magnets are demagnetized the pressure of the water is relied upon to center the rudder.

A part of the motor current is used to excite the steering magnets; the relay and steering current turn it from its normal path to earth, through either steering magnet to earth.

To regulate the distance of torpedo below the surface a float about 20 feet long is used, pointed at both ends; a section at any point being nearly triangular; its breadth is greater on top than on the bottom; this is connected with the torpedo by two broad knife-edged steel bars, which pass through a well in the float; by means of set screws the distance of the torpedo below the float can be regulated. This distance is usually three feet. Signals, either flags, or hooded lights, are attached to the float to assist in guiding the torpedo. The current for the motor is furnished by a No. 5 Weston dynamo; the steering current by a battery of Grove cells (1880).

The relay used was designed by Mr. M. G. Farmer; the diagram below (Fig. 6) gives a general plan of the connections, &c. This relay consists of a permanent U-shaped magnet, *B*, attached to a base-board; an electro-magnet, *A*; is placed with its poles at right angles to, and between those of the permanent magnet; attached to, and polarized by the permanent magnet are two small armatures, *n* and *s*, which normally rest against two contact points, *x* and *y*; by sending a current in either direction through the electro-magnet coils these armatures may be attracted at pleasure. The steering conductor of the cable is connected to one end of the electromagnet coil, the other goes to earth—the motor current, on leaving the motor, is connected with the permanent magnet; one end of each of the steering magnets, *C* and *D*, is connected to the permanent magnet; the other ends to, *x* and *y*; *x* and *y* are also connected with resistance coils, *a* and *b*, which have a resistance equal to that of the steering magnet coils, the other ends of the coils are connected to earth. Normally, the motor current passes by way of the permanent magnet armatures, *n* and *s*; the contact points, *x* and *y*; through the coils, *a* and *b*, with a resistance of one-half of one of them, thence to earth. Now, let the steering circuit be closed and the armature, *n*, or *s*, will be attracted, according as the current is direct or reverse. Suppose *n* attracted: the motor current now divides, one-third passing to earth through the magnet, *C*, and the resistance coil, *a*, and two-thirds by way of the contact point, *y*. One-third of the total current is sufficient to operate the steering magnet. If the steering current be reversed the opposite action will take place and the steering magnet, *D*, will be operated. Small springs are used to bring back the armatures, *n* and *s*, when the steering current is not in use. The fuse is exploded by an apparatus which closes its circuit upon reversing the motor current. A speed of from 10 to 11 knots per hour has been obtained in this torpedo.

The most successful torpedo of the automovable type, and that which has received the most attention, is the one invented by Mr. John L. Lay, formerly an officer of the U. S. Navy; this torpedo has been supplied under contract to many of the great powers and has been the subject of many flattering official reports as to its excellent operation under very trying tests.

The Lay torpedo is, in general shape, fusiform, or spindle-shaped; the hull is made of sheet iron 0.08 inch thick; the length is about 24 feet, and maximum breadth about 30 inches. It is divided into the following compartments, viz:

1. The magazine with a capacity of 200 pounds of gunpowder which is exploded by electricity. The magazine is so arranged as to be detached, being brought up with hanging chains, when a steel bar, which extends about two feet in advance of the prow, is struck. The wire by which the charge is exploded passes forward from the "reel chamber."

2. The compensating water chamber is simply an air space into which water is admitted automatically as the gas which operates the motor is expended.

3. The flask compartment contains the wrought iron flask which is charged with about 350 pounds of carbonic acid gas compressed to liquid form.

4. The cable drum chamber is next in rear of the flask compartment and contains the conducting cable which is paid out, either through a hollow propeller shaft, or through a tube, especially for that purpose.

5. The last compartment is the machinery

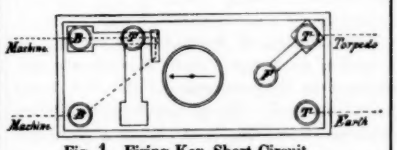


Fig. 1. Firing Key, Short Circuit.

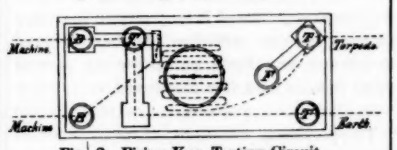


Fig. 2. Firing Key, Testing Circuit.

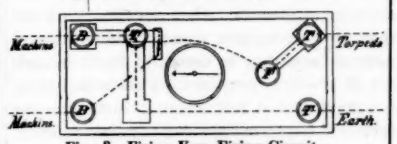


Fig. 3. Firing Key, Firing Circuit.

chamber; here is located the mechanism for moving and directing the motion of the torpedo. The engine is of the three-cylinder Brotherhood type, and is operated by carbonic acid gas; the throttle valve, to regulate the admission of gas to the engine, is operated by electricity, as follows: the armatures of the "engine magnets," which are of the axial type, are connected to a beam which is pivoted in the center, so that as one is attracted the other is withdrawn from its coil; the beam, by means of a bell-crank, works the valve admitting gas to a small cylinder, the piston rod of which is attached to the rod of the main throttle valve; this valve is normally kept closed by means of a spiral spring around its rod. Now, if the one armature be attracted, the throttle will be opened, if the other, closed by the spring, the cylinder being opened to the exhaust.

In rear of the motor is the steering engine which is supplied with gas by a separate flask and operated by electro-magnets. On top of the rudder, and at right angles to the same, is placed a tiller, which is attached to the steering engine piston rod by a connecting rod. When the piston is at either end of the cylinder the rudder is either to starboard, or port, and when centered, the rudder is also centered. The slide valve, scored large enough to cover the three ports with which the cylinder is fitted—two to gas and one to exhaust—is connected to the armature of the magnets by its stem. The armatures are connected so that if one moves the other also moves.

The magnets are so placed that when one armature is attracted one port is opened to gas, the other to exhaust; when the other armature is attracted the opposite effect takes place, and the condition of the ports is reversed. When both armatures are equidistant from their magnets both ports are open to the exhaust.

Suppose a current to be sent through one of the steering magnets, the armature will be attracted and the piston go to one end of the cylinder. If it is desired to center the rudder: the current is sent through the other magnet and the piston commences to move to the other end of the cylinder. On a piece of metal secured to the cylinder, is pivoted a piece of steel with two projecting lugs, or toes, the upper part is connected to the valve stem by a loose joint; on the piston-rod is a knife edge, which, coming in contact with the toe lever each time it passes the center, centers the valve and, at the same time, the armatures. If it is desired to shift the rudder to the other side, the key is touched again. This plan was found to be delicate of adjustment, and in 1881, was changed. The new arrangement was to center the armatures of the steering magnets with a spring. On the rudder-post was placed another tiller extending aft; on either side; forward of the rudder-post, were placed two long flat springs. Now, it is plain to be seen, that if the rudder post be turned, the extra tiller will be resisted in its motion by the springs; and these are relied upon to bring the rudder back to amidships when the current is broken. The key is held down as long as it is desired to keep the helm to one side, and, when wishing to steady, let go.

In all the later Lay torpedoes a polarized relay, to work without a local battery, has been introduced with success.

The keyboard used is an arrangement to connect the five terminals of the five conductors used in this cable, with a spring contact key; one pole of a battery is in contact with an anvil under each key, the other pole is connected to earth. Bunsen's cells, coupled in series, are used.

In one of the earlier forms of this torpedo a very ingenious pattern of relay was employed, permitting the use of a single wire conducting cable from shore; the arrangement of the steering gear was different, two cylinders being used.

The two steering magnets worked, by means of their common armature the, stem of a three-way valve admitting gas to one or the other of the steering cylinders, the piston rods of which were attached to a yoke on the rudder head. The rudder was centered by a rubber spring.

The three-way valve was so constructed that when one armature was attracted the one cylinder was opened to supply and the other to exhaust; when the other armature was attracted the reverse took place. When the armature was centered both cylinders were opened to exhaust. The electrical apparatus used consisted of a main battery and keyboard on shore. The battery consisted of six small Bunsen's cells connected in series. The zinc pole, and the carbon poles of the second and sixth cells were connected with the keyboard.

The keys of the keyboard were so connected that by manipulation of the four keys, positive and negative, strong and weak currents could be sent over the cable to the torpedo. An earth circuit was used with the main battery, ground being taken from the keyboard and relay.

The relay (figs. 7 and 8) consisted of a permanent horse-shoe magnet, *N S*, placed vertically, and an electro-magnet, *m m'*, so placed that its plane should be at right angles to that of the permanent magnet.

Figs. 4 & 5. Electric Switch.

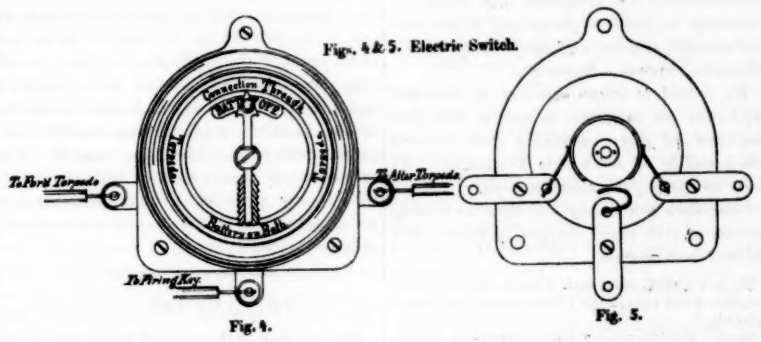


Fig. 4. Fig. 5.

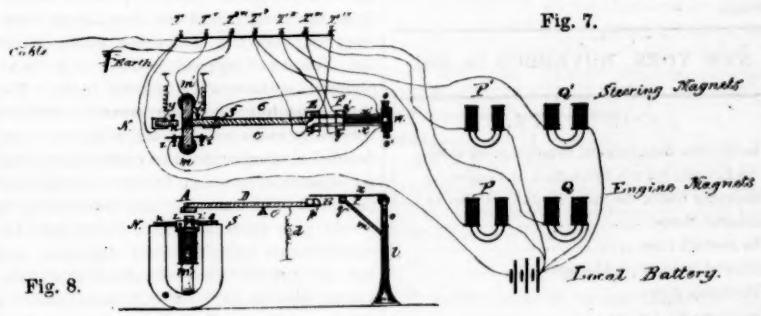


Fig. 7. Fig. 8.

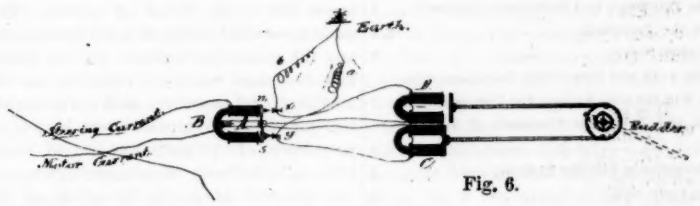


Fig. 6.

Pivoted at the ends of the latter were two armatures, *n s*, which were normally pulled back against insulated points, *y y'*, by the springs, as shown in the diagram, which is conventional, simply. Opposite were two contact points, *Z Z'*, which were fixed in insulated bouchings in the brass plate attached to the electro-magnet. Above the poles of the electro-magnet was a soft iron armature, *A*, which was secured to a lever, *D*, the fulcrum of which was at *C*. On the end of this lever was an ebonite block, *E*, through which passed two metal screws, *p p'*, one on each side of the lever; the motion of the lever was confined by a stop, and a spiral spring, *d*.

Projecting from the metal pillar, *l* was an arm *m*, carrying at its end an ebonite block *F*, through which were two screw points, *q q'*, one on each side of the arm, *m*. Between the arms, *O O'*, of the fork of the pillar, *l* was set a cylinder, *w*, to which were attached two metal springs, *x x'*, which are insulated from each other, and from the pillar, *l*, these projected over, and normally rested upon the screw points, *q q'*, but were not in contact with, *p p'*.

The connections are as follows: The terminal, *T*, to the carbon pole of the local battery, also to the permanent magnet; T^2, to

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

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On account of the building not having been cleared in season to allow the exhibits to be set up in the M. C. M. A. building in Boston, the Electrical Exhibition, which was to have opened on the 24th inst., has been postponed until December 1st.

It is stated that already a goodly number of exhibitors have applied for space in the electric exhibition in Boston, which has been allotted them, and enough exhibits have been received to make a very interesting display. At the building the work of clearing up has been rapidly pushed, so that the halls are now practically cleared, and several exhibits are already in the building.

The low rates which the Bankers and Merchants' Company has fixed between Boston and New York—fifteen cents for ten words, and a cent for each word additional—is having the effect to make patrons send more words, because, at such low figures, it does not pay to cut out the short words, or to study economy in phrasing a message. It is always poor economy to cut and trim a message until its meaning is vague, and when rates are practically down to a cent a word no one thinks of doing it.

Everybody is watching and waiting for the decision in the Bell-Drawbaugh suit. It is not only the holders of stock who are interested. There are a number of subordinate companies who have new works laid out and waiting to be done, but until they know that they are to be protected in their territory they do not feel much like launching out. Should the decision be favorable to the Bell Company, we shall expect to see a great deal of work done and a large increase in the output of telephones.

Senor Romero, the Mexican minister, has transmitted to the secretary of state a decree issued by the state of Yucatan, Mexico, offering a prize of $20,000 to the inventor of a machine which shall successfully extract the fiber from henequin, under the following conditions: It must be automatic and not require skilled and experienced workmen to manage it. It must be entirely free from danger to the operators. It must require less motive force than the machines now in use with relation to the producing power. It must increase the production or extraction of the fibre within a given time, diminish its loss, compared with the various machines in use. The reward is to remain open for three years, at the expiration of that period the government of Mexico will appoint a commission, who shall decide as to the merits of the machine, when the successful competitor will receive the sum named. The concession of that reward is without prejudice to the right of proprietorship and of patents that inventors may merit conformably to the laws.

THE NEWARK CASE.

The decision of the court in the matter of the Newark Telephone Company, whose license from the Long Island and New Jersey Company expired some time since, really leaves the Newark Company, which was complainant, without a leg to stand upon. The chancellor, in his decision, went into the case very fully and carefully, and related in very decided language, that the complainant had no shadow of a claim to the contract, and that neither his court nor any other could or would give them another. From this the complainants have naturally appealed, and last week went before the chancellor again, asking him to hold the defendents under a staying order until their appeal could be heard before the Court of Errors. They made a very full argument upon their motion, but the chancellor refused, on the ground that they had really no rights in the case whatever, and therefore could not reasonably ask the court to protect them in keeping possession of property which in reality belonged to others. The chancellor's opinion and his order stating that he had heard their argument requesting a stay pending an appeal, and had desired it to go up to the Court of Errors as part of the case, a reversal of the original decision seems far from probable, although, in law, pretty much anything is possible. As we understand the case, it was a matter of contract which was to extend up to a certain date, after which it was to cease, and the territory licensed was to revert to the Long Island and New Jersey, unless they saw fit to enter into a new contract. It is certain that such was the extent of the contract at the time it was made—whether the papers as drawn made it clear or not, it is not for us to say, but the chancellor seems to think that they did. The case is an important one, because there are many holding limited telephone licenses from the Bell Company who would be glad to find some way to compel the Bell Company to renew their licenses upon their expiration, and who have cherished the idea that somehow the armory of the law contains some weapon which, properly used, would force them to do it. Should the decision of the chancellor be sustained—and the chances are largely that way—these illusions will be very largely dispelled, and companies acting under limited licenses will be squarely brought to a realization of the fact that a contract is "off" when the time is up.

EDITORIAL NOTES FROM CHICAGO.

Chicago furnishes an excellent exemplification of the evils that may be done by hasty and unwise legislation. As is well known, a law was passed here some time since forbidding the putting up of any more overhead wires, the idea being to force the various companies to go underground. So far as annoyance or possible danger from overhead wires is concerned, the ordinance practically amounted to nothing; for, seeing that it was coming, the several wire companies, with the exception of those having electric lights, strung hundreds of miles of wire in anticipation of future wants, and, in the more densely populated portions of the city, have not yet exhausted this surplus. In the outlying districts, where the streets have grown up within the last few years, and where the poles and wires, if put up, would inconvenience no one, the ordinance forbids their erection, and the result is a good deal of annoyance and inconvenience to people who really want and need the telephone, but cannot have the service. In fact the inconvenience is much greater to the people than is the loss to the telephone company, for these scattered subscribers in outlying districts are but the skim-milk of the business, and seldom pay, when the cost of maintenance of long lines of wire is taken into account. Thus the telephone company confines its service within limits comparatively narrow, and pretty much all of its business is "fruit."

The scheme of having one central or principal exchange, with subordinate exchanges in different parts of the city, is not in vogue here. There are nine exchange stations, but neither is any more a principal exchange than any other, all being of equal importance. Indeed it may be said that they all comprise one exchange, the boards being in groups, and these groups being several miles instead of a few feet apart.

The service is excellent, prompt, accurate and rapid. That is, it is rapid enough. The average connection, when not through more than two exchanges, comes inside of half a minute, and that is certainly rapid enough for all practical purposes. I know that there is a good deal of talk about "instantaneous service," but to my mind it is rather fanciful than real—a good thing to talk about, but next to an impossible thing to accomplish. We cannot tell what the future may or may not have in store for us, but, for the present, it seems to me that when subscribers can "get" people two miles away and talk with them within a half-minute or even a minute from the time they ring, there is very little occasion to find fault.

I find that what we in the East know as the "Providence system" is in high favor here, and likely to be adopted in all its details. As I have already made my confession to and my peace with Mr. Duxbury, I suppose I may as well own up that it was I who stirred that matter up last spring, and, under the guise of a "subscriber," ventured to criticise the service given by the Rhode Island Telephone Company. Of what I said then, so far as the facts stated are concerned, I have not one word to retract, for the simple reason that everything said was based on my actual personal experience in that charming city of genial hosts and succulent clams, where the gulf stream imparts its warmth not only to the air but to the hearts of the people, and makes it the most hospitable "plantation" in bleak New England. But when I had talked with Mr. Duxbury, got at some of the inner facts, and felt the influence of his "winning ways," I had to admit that there were two sides to the question, and that people whose opinion and experience could not in justice be discarded, were wholly opposed to me in opinion. And so I am forced to say after talking with people here, and doing some little independent testing on my own account, that, if a tree is to be judged by its fruit, the Providence system of switching gives excellent and highly satisfactory results, and, "what wouldst thou have more?" It is rather a nuisance to the subscriber, to have to wait with the telephone—Heaven forbid that I should ever learn to spoil a good word by calling it a "phone," as they do out West—at his ear, and to repeat the name of the party wanted always once and sometimes twice, but, as it expedites the service and relieves the operators, perhaps he ought not to grumble. He gets his money's worth and a good deal more, and for the "more" he ought to be willing to put up with some annoyance and "lend a hand."

This fact that every telephone subscriber "gets his money's worth, and a good deal more," brings me to a mention of some discussion I have had with telephone men hereabouts concerning telephone charges and how they should be regulated. Perhaps it is just as well to say that I find folks here fully wedded to the "flat" change system, the system of making the price so much per annum, and letting the subscriber use the instrument to his heart's content,—in a word the usual system. I do not find them claiming that, in this big city, the prices charged are anything more than fairly remunerative, nor do I hear them denying that, as the number of subscribers increases, it will be less and less remunerative. I think I gather from their remarks that it is vain to hope or expect to raise the price. I also judge that, despite the printed notice attached to each box, there is quite as much "dead-head" use of the instrument here as anywhere, and I am quite certain that the subscribers in this town are quite as much given to frivolous and unnecessary talk as those of any other place in the country. I think all with whom I have talked recognize all these difficulties, and their probable influence on the future of the business, but I find them resisting the toll system stoutly.

It is only fair to state their position. If I fail to do it justice, it is because I have not fully grasped it. But, in brief, it is that telephonic and telegraphic service are, of necessity, and from their very nature, wholly different. The latter, they say, is like hiring a carriage from a stable, paying for what you get, while the former is your private buggy, always standing ready at your door, ready to be jumped into. They say that the telephone must be made popular, to be used at every turn as one would use a speaking tube, without thought of a charge each time it is used. They say it is true that the telephone hanging in a man's office is "on tap" all the time and that it is possible to overuse it; but that, as a matter of fact, this does not happen, any more than it happens that a man staying at a hotel eats all the time because some meat is always on the table. But here, it seems to me, the reasoning does not hold. The limit of a man's eating is fixed by his appetite and capacity, which *do not* grow by that upon which they feed. To eat after the one is filled and the other satisfied is a source not only of pain but of illness. But, on the other hand, the use of the telephone, especially in a business office, grows upon a man, not merely because the number of subscribers increases, but because "use breeds a habit in a man." Col. Parker of the Boston Exchange, and Col. Eckert of the Metropolitan Company in New York—telephone managers, judging by their titles, are very warlike—could tell of business men who make it a rule in the morning to sort out their city and suburban letters first, read them, and *answer them by telephone.* It expedites business, it saves the writing of many letters of a purely routine character, and it is *easy.* We are all, every man jack of us, lazy by instinct, and if we can avoid work we do so. Lots of men send a telegram when a letter would really answer, because it is so much easier to pencil a message on a blank of rough manilla paper, pull a call, and let a messenger come for tt, than to write a letter, fold, envelope, address, stamp and mail it. There are many business houses in all our large cities—and the number is growing daily—where a small room is set apart for the telephone, in which a clerk sits constantly

answering calls, summoning from their respective departments the persons wanted, and often transmitting to other business houses messages sent in to him or her in pencil by the proprietors. This increase and systematic use of the telephone is growing daily in every large city, and is destined to grow much, very much more. A man gets indignant and vexed with the telephone when *he* has to wait, but when he hires somebody else to do the calling and the waiting it does not trouble him half so much. He is not only paying for the telephone but for the clerk as well. He means to get the worth of his money, *and he gets it.*

But, it is claimed, these cases are exceptional. Granted. They are not sufficiently numerous to be a really important factor in deciding upon a system. Granted, so far as the present is concerned. But how about the future? This more extended, constant and systematic use of the telephone is to-day "no bigger than a man's hand." But it is growing, it is causing the more frequent use of the instrument by all others, and it is destined to be the chief and most important factor of all in the problem.

But to come back to the proposition as stated by my friends here at the outset, what real reason is there for saying that the two services, telephonic and telegraphic, are so inherently different that the system of charging for them must of necessity be radically different from the foundation up? It is a broad statement, but where is the justification for it. If every one could operate a Morse key, everybody could have had the telegraph with a central office attachment, just as the Law folks had in New York. The telephone came in to substitute spoken words for taps on the sounder, a language that all understand for one that few understand. Practically, that is all the difference, and why a high board fence should be built between the two, establishing the pay-for-what-you-get principle on one side, and the pay-so-much-whether-you-get-it or-not principle on the other, is not quite clear to me up to the present time.

I confess that I was surprised not to find the Multiple Board in use here, but I think there is a very good reason for it. The Exchanges were equipped with the older form of board, and as they increased in size additions were made. To introduce the Multiple would involve discarding all these old boards, which are doing excellent service, and the outlay of a very large amount of money which the needs of the company do not really warrant. But this argues nothing whatever against the superior advantages of the multiple board, or the advisability of using it when a new outfit becomes necessary. At the Western Electric Company's establishment I saw the boards which they have just completed for the New England Company's Boston Exchange. They are very similar to those shown at Philadelphia, the modifications being very slight, and are as handsome pieces of cabinet and electrical work as one would wish to see. I hope to see them unpacked in Boston, and shall be greatly interested to see what change, if any, is wrought by them in the rapidity and character of the Boston service, which is certainly all that anyone can reasonably ask as it stands to-day.

I have been very much interested in watching the process of manufacturing the Patterson cables as carried on under Mr. Patterson's personal supervision at the Western Electric Works. Quite as interesting as the cable itself, is the special machinery designed for and used in its manufacture. I judge from what I have seen that a great deal has been learned from experience, and that the cable is not only more economically but better made than ever before. I had an idea that in some way the lead tubing was formed over the cable, by some cold drawing process, and it may interest some who are as far out as I was to know that I was entirely wrong. The conductors are "bunched" by machinery, and slightly twisted, and then, after being wound to keep them in place and thoroughly paraffined, they are drawn into the lead pipes in one hundred foot lengths, which are afterwards soldered together, there being no breaks in the conductors, which are in lengths as wanted, up to twelve hundred feet. These lengths are then taken and pumped full of hot paraffine which has been charged with carbonic acid gas under heavy pressure. The minute globules of gas take up the expansion where the paraffine expands by heat, and expand again when it it contracted by cold, so that the tube is always full, while neither internal bursting pressure or external collapsing pressure ever comes upon the tube. When once the paraffine is cold both ends of the cable may be unsealed, for the compensating globules of gas are safely held within its substance.

The process just described is followed in the manufacture of all the Patterson cables for whatever use intended. Those which are to go underground are in heavier tubes than those intended for overhead use, and those supplied for submarine use are heavily armored with iron wire by means of a special winding machine devised by Mr. Patterson. So far as I can learn, these cables are giving excellent satisfaction, and seem to come as near overcoming the various electrical difficulties as any now offering. Their popularity is attested by the fact that Mr. Patterson's department is full of orders, and that his output is only limited by the capacity of the factory. For overhead use over reasonable distances they seem to fill the bill admirably, and it is for this use that they are chiefly made.

The rooms in the Western Electric's Building which are devoted to insulating wire look like the spinning rooms in a cotton factory, and have that "whirr" in the air so familiar to the ears of those who have lived in manufacturing cities in the East. When it is remembered that every wire has to be wound once, and sometimes twice, with cotton or silk, according to the use to which it is to be put, and that all the large wire for arc currents has to be braided over with coarse cotton yarn, it will readily be seen that this is by no means an unimportant part of the company's work.

In a corner by themselves I saw two men at work. Each had by his side a large pile of zinc ingots, and near at hand a smelting furnace, with a pot of melted zinc. All day long, week in and week out, these men stand there, ladling out this liquid zinc into iron moulds of ingenious construction, casting "crow-feet" for the acids in hundreds of thousands of gravity cells to feed upon. It eats slowly but steadily, and the aggregate consumption is enormous. A little brass screw-cup is cast into each "crow-foot," and when sold they are all ready to be used. It is an impressive reminder of the extent to which electricity has become the servant of man to see these two men working with might and main to keep up with the demand upon the Western Electric to keep good the supply of zinc.

Not to be behind its competitors in the electrical business, the Western Electric has its "ownest own" arc lamp, and a very good arc lamp it is, attractive in appearance, handsomely and compactly made, and giving a very good light of about the usual power. It has not been very extensively introduced as yet, but, wherever used, it has given entire satisfaction. Of course, it has its own special dynamo and "accompanying documents." There is no reason why it might not be "pushed" like the others and have its share of the business, but the introduction of a new light is a trade by itself, and, before it is done successfully in this case, it will probably be necessary to organize a special independent force for the purpose, *unless* ——

"Unless." I know that Mr. Barton and the other gentlemen will pardon a suggestion. It seems to me that the time has come to manufacture and sell lamps and dynamos just as one would sell stoves or gas fixtures; that is, outright, and at a fair manufacturer's and patentee's profit. The licensing scheme was all very well at the outset, but arc lights have become a necessity, the public have been educated to expect and require them, and I can see no good reason to suppose that the removal of all restrictions and the simplification of the business would not tend to greatly extend their use. To put it plainly, the prices that have been charged for lamps and dynamos have been out of all proportion to their cost, and a proof of this is found in the fact that there has been no end of private "cutting," while list prices have been nominally maintained. If there were but one good light—as there was but one McKay sewing machine—there would be some reason in maintaining the license system, but the fact is that there are half-a-dozen lights which are good enough—each having its special advantages—*and its special disadvantages*—and it seems to me that now is the time for somebody who has a good light to do away with all this "list price" foolishness, and sell their product as they would bootjacks or shovels, to anybody that wants them. Isn't the Western Electric, with its excellent light and its superb manufacturing facilities, just the one to lead off in this line.

Speaking of arc lights, I hear—one must go away from home to get the news—that Mr. Edison is absorbed just now in an arc lamp of his own device and construction. He toyed with the Pilsen lamp, but it didn't suit him, and so he invented one of his own. This seems a little funny, considering how, only a little more than one short year ago, in a published interview, he sat down hard on any and every form of arc lamp, and practically declared that it "must go." This only shows that Tom Edison is a good deal like the rest of us—apt to be "too previous," and that even the genial "Wizard of Menlo Park" can't always tell. I fully expect to hear, within a year, that he is at work on some new form of storage battery, despite all the ridicule he has heaped upon the system. He has probably forgotten more about electricity than most of the electricians know, and once in a while he seems to forget that, outside of pure mathematics, "impossible" is a forbidden word.

I got hold of a story about Edison, the other day, which it will do no harm to put in here. A young man now holding an important position with the Edison Company, had just graduated from a scientific school, and was casting about for work. He met Edison, and asked for a chance, stating where he had been educated. Edison told him that he had had poor luck with scientific graduates, and didn't feel encouraged to try any more. "I suppose you know it all?" he continued. "On the contrary, Mr Edison," answered the applicant, "I feel that I don't know anything about it. *I want to learn.*" "My dear boy," said Edison, brightening up, "I am delighted to know you. Come right over to the laboratory and go to work." That was over three years ago, but the young man is "at work" still, and is recognized as an electrician of high attainments; but he realizes the limitations of his knowledge of the science more to-day than ever. But what has this got to do with Chicago?

The wise men of Chicago, in other words, the City Fathers, issued an edict long ago that no electric light wires should be run through the streets, and the consequence is that Chicago, which one would naturally expect to find one of the most brilliantly lighted cities in the country, is particularly dark and sombre at night, except in certain spots, where somebody has established an isolated plant. These are particularly brilliant, more so than there is any occasion for, and the result is that the other parts of the city look all the more dark and uninviting after nightfall. There being no city electric lights, and those used by private parties being limited to those who can have isolated plants—such as the hotels, theatres, and some of the larger stores—the local business of the several companies is not very good here. A little something is done in carrying wires from one block to another by boring under the streets, but this is very limited, and is now forbidden without a special permit from the City Fathers, a thing practically impossible to get. A right of way under the streets has been granted to a local conduit company, which, so far as I have been able to learn, has no successful conduit down, and little or no money to put one down, its chief asset being its franchise, which will no doubt be valuable some day. In the mean time it would contribute to the pleasure, convenience and security of the people of Chicago, if the ordinance forbidding the stringing of arc light wires were rescinded, and reputable companies, having good lights, were permitted to establish central stations and do commercial lighting, such as found in other cities. And if contracts were given them for a large number of city lights—the territory being properly divided among them—it would be such an improvement that, once adopted, the citizens would never consent to go back to gas. Chicago is a city with a very large element of population which is at times unruly and turbulent, and in no city in this country outside of New York, is there greater need of light in abundance as a means of preventing crime and aiding in its detection. One is almost tempted to believe, in view of the well-known experience in other cities where the electric light has done so much to improve the character of streets upon which it is used, that the City Fathers of Chicago are not unfriendly to the criminal classes, nor anxious to interfere with their nefarious trades.

But it must be admitted, as an offset, that the city has adopted a very excellent police call system, with the telephone as the basis, and that, by means of patrol wagons, the force can be concentrated at any point in a very brief time. In these respects—promptness in calling by means of police stations at the more important street corners, and rapid transportation of policemen by means of patrol wagons always ready to start for any designated point—Chicago is far and away ahead of the leading eastern cities, and is just a little proud of the fact.

It hardly needs to be said that the telegraphic facilities of Chicago are excellent. It is a "competitive point" of the first order, and the several companies vie with one another in serving the public. The newcomers have cut rates away down, and these the Western Union meets through the Mutual Union, keeping its own rates up to old figures. Of course this takes a good deal of business from it, but, notwithstanding this, it has all it can jump to, and its wires are kept hot all the time. As has been said in your columns, the demands which the public make for telegraphic service keeps fully abreast of the facilities afforded, and its growth was never so rapid as at the present time. I have a notion that, within the past two years the Western Union has not done what it might, and should, in the way of repairs and reconstruction; and that it is quite as much for this, now much needed, as for the possible contingency of lines coming upon the market for sale, that it is proposed to cut down the dividend from seven per cent. to six. The difference, one per cent. of eighty millions, say $800,000, will do a big lot of work in the way of replacing old wires with new, and increasing the plant to meet the public demand for service. As for any very desirable lines coming upon the market for purchasers, it is hardly to be expected, for any well and honestly built line between points of any sort of prominence in the United States to-day is worth all it really cost in quick cash, and would not have to seek a customer. No one who has any conception of the rate at which this Western country is growing, or of the extent to which its people are learning to depend upon the wires for all purposes, social as well as commercial, can doubt for one moment that the expectations of the most sanguine telegraph enthusiasts will be more than realized in the future.

Telephonic News

⁂ J. J. Storrow, Esq., counsel for the American Bell Telephone Company, sailed for Europe, Friday, November 7.

⁂ Conversation was held by telephone between St. Petersburg and Bologne, a distance of 2,465 miles, recently. The experiment was conducted at night.

⁂ In the Legislature at Montpelier Friday a bill was introduced to compel telegraph companies to send all messages of less than twenty-five words for fifteen cents, and granting free delivery within one-half a mile of an office.

⁂ The Telephone and Telegraph Construction Company of Michigan have lately placed with the Palmer Wire Company an order for three hundred miles of hard-drawn copper wire, which they propose stringing this season.

⁂ Editorial sanctum—The five thousand and tenth ring at the telephone. Growler responds. "Hello!" "Hell-o! hell-o! hell-o!" "Telegram office?" "Yes." "Who is President?" "Chester A. Arthur." "Ah-h, funny ain't you?" "No; simply correct."

⁂ After two years of bitter competition in the telephone business in Rio de Janeiro, Brazil, between the Companhia Telephonica de Brazil and the Companhia de Telegraphos Urbanos (the former having eight hundred subscribers, and the latter about 750), a basis of consolidation has been arrived at

⁂ Forty-five towns in the German Empire are now provided with telephonic systems, having a total number of 7,549 subscribers. Berlin has 17 subscribers per 1,000 inhabitants; Mannheim, 21; Hamburg, 28; Frankfort, 25; and Stettin, 23. It is probable that new subscribers connected by the end of this year will bring the total up to 9,000.

⁂ The telephone has been employed recently for the exercises in artillery firing at Newport, in England. The target was placed at a distance of more than 6,000 yards from the cannon, where it was invisible to the gunners. Instructions given by telephone were, nevertheless sufficient to enable the gunners to regulate the firing in a perfectly satisfactory manner.

⁂ It is said that the Philadelphia telegraph and telephone companies are still perplexed by the problem of placing their wires under ground. The city ordinance compels the change before January 1, and the city solicitor has just given an opinion that nothing in the charters of the companies can prevent its enforcement. The chief of the electrical department has been unwilling to collect the customary license fees from the companies, lest this should be construed as authorizing the continuance of the system of poles and wires for another year. A committee of electricians has been asked to aid the electrical committee of councils in devising efficient measures for relief. There are about thirty corporations and firms maintaining overhead telegraph and telephone wires.

⁂ One of the most remarkable pieces of telephoning yet attempted has just been accomplished by the engineers of the International Bell Telephone Company, who, it is claimed, successfully carried out an experiment by which they were enabled to hold a conversation between St. Petersburg and Bologne, a distance of 2,465 miles. Blake transmitting and Bell receiving instruments were used, and conversation was kept up, notwithstanding a rather high induction. The experiments were carried on during the night, when the telegraph lines were not at work. The Russian engineers of this company are so confident of further success that they hope shortly to be able to converse with ease at a distance of 4,665 miles; but to accomplish this astonishing feat they must combine all the conditions favorable for the transmission of telephonic sounds.

⁂ The director of the manufactory of telegraphic and telephonic apparatus at Neufchatel, Switzerland, has patented a michrophone the use of which may be very advantageous in telephonic systems. This apparatus works without an induction coil and is connected directly to the telephone line. Only one single battery, situated in the central office, is required for all of the subscribers, and none is required in the subscribers' offices; the number of cells of battery is thus reduced and a notable economy is realized on the cost of their maintenance. Notwithstanding the abolition of the induction coil, the sounds transmitted by this microphone are very clear and distinct.

⁂ The table given below shows the great development of the telephone industry in Italy, and the brilliant future which is in store for it:

Cities.	Number of Subscribers. On August 30, 1883.	Number of Subscribers. On August 30, 1884.	Increase.
Turin	577	1,140	563
Milan	520	1,087	567
Genoa	515	828	313
Florence	521	742	221
Bologna	318	436	118
Leghorn	240	317	77
Rome	923	1,351	428
Naples	539	641	102
Venice	185	190	5
Palermo	253	333	80
Messina	113	124	11
Catania	130	181	51
Totals	4,834	7,370	2,536

This statement is only made up to August, 1884. It should be observed that in the cities of Turin, Milan, Genoa, Florence and Bologna amalgamations have been made during the cuerent year with competing companies; the increase in the number of subscribers in these localities is none the less remarkable.—*La Lumiere Electrique.*

Telephone Flirtations.

WHY THEY USUALLY FAIL OF SUCCESS—THE ETIQUETTE OF TELEPHONIC SELF-INTRODUCTION.

"Are your lady operators annoyed by subscribers attempting to flirt with them by telephone?" was asked of the manager.

"Well, there is a disposition on the part of giddy young men and frisky old ones to talk a little sweet to the operators. This is especially noticeable on Sundays and after business hours. But the girls are watched very closely, when we detect any inclination on their part to carry on other than business conversations, and as all our operators came to us with good references, we have very little trouble on this score. As a rule, as soon as a subscriber begins to be spoony they plug on the chief operator, and the manager is thus made aware of all such attempts. Very few episodes of this kind occur without the company finding it out. I have the names of a great many young men who have made such attempts, and there are notes in my desk now concerning the actions of several young bloods about town which would form an interesting chapter if they should be divulged. I have no doubt it would take away the breath of several well-known men if they knew the telephone company is aware of the flirtations they carry on with our girls over the wires. Yes, we know what the character of our subscribers is, and there is not an operator here who is not familiar with traits of most of them. The excitable ones, the swearing members and the spoony subscribers can be called by name in almost any part of our offices.

To many young men of an over-sensitive nature the perplexing question has sometimes arisen, "How should I announce myself when some one asks 'Who is it?'" There are some who solve this matter by promptly answering on all occasions, "It is Mr. Jones," or "Mr. Smith," as the case may be. Others, however, look upon this form very much as they do on having "Mr." printed on a gentleman's visiting card, or the title "Colonel" on an election card. While the solution of the problem must be left largely to the individual, it may afford him some relief to hear the views of a well-known gentleman of this city, who is popularly regarded as pretty near authority on matters ef etiquette. Said he, in discussing the matter recently: "In answering a lady it is always proper to say: 'This is Mr. Black.' It should not be considered an affectation, for it is really uncouth to blurt out, 'This is Jones talking.' Of course a very young man should not use the title at all, but, when it is not proper to use the Christian name in connection with your name, it is perfectly correct to use 'Mr.' in announcing yourself. In speaking with gentlemen a justifiable regard for your own dignity will prompt you to use 'Mr.' to those who are not intimate friends or your superiors in business relations."

A pretty good sample of amusing errors which may occur in the use of the telephone is reported from the office of a gentleman in this city, and as its truth is vouched for it is additionally interesting. A young business man rang up, calling for a gentleman friend. The operator mistook the number, and a lady's voice answered:

"Hello; what do you want?"

"Well, who are you?"

"I'm 70."

"You're too old. I want 17."

Tableau.

The Erie Telegraph and Telephone Company.

To the Editors of the Electrical Review:

SIRS,—The Erie Telegraph and Telephone Company still holds its own in Arkansas. Though we have had any quantity of talk about "Pan Electric," "Rogers'," "Baxter," and Heaven only knows how many other wonderful and improved telephones that are to completely rout and run out the Bell instruments, and do away with exorbitant prices (we get $48 and $60 per year) and monopoly, about the only effect, so far, has been to cause some parties to delay subscribing, in hopes of lower rates; but these, apparently tired of waiting, are now coming in, and signing yearly contracts. This exchange is growing steadily, and now numbers 325, and we have just added another 50-wire section W. E. switchboard, making a capacity of 350 wires. It is now five years, the 1st of November, since the exchange was first started by the Western Union Telegraph Company. The telephones first used were Edison transmitters of the Universal style, and Phelps' "Pony Crown" receivers. A large part of the lines were worked on a closed circuit, with a relay and Prescott call-boxes, with several instruments on each wire. We had about one hundred cells of call and battery at the office, and a picnic once a week to clean them. Troubles were plenty and hard to find; but the telephone was comparatively new and subscribers more patient then. We still have some Edison 230 Fig's, or box transmitters, in use; but there is only one of the old Universal sets left. It is one of the very first lot received, and is still in use, giving good service in the same office and on the same spot on the wall where first placed, over five years ago; has never been moved or changed, or had much of anything done to it, except to renew the battery. Where is the telephone that can show a better record? Won't some other manager please trot out his oldest?

A. F. A.

Little Rock, Ark., Nov. 10, 1884.

Editors Electrical Review:

I read your description of the telephone interests in the Northwest with much interest. With your kind indulgence I wish to make a few supplementary statements which will explain some things which I can vouch for from actual experience.

When the Erie Company acquired the territory in question the plant was found to be in a most lamentable condition. The lines were insufficient, built in a very improper and unsafe manner, the apparatus were of the oldest and worst type, and the office was fitted up in an attic with poor apparatus, and with insufficient help. The management selected for this task, was Arthur S. Temple, It was a peculiar position; the people, already disgusted with the telephone business, and with a western suspicion of Eastern ability, gave little encouragement and no assistance.

In a little more than a year all this was changed. Lines in sufficient number were built to take charge of the trunk business, new pole lines through all the principal streets were built, an entire new outfit was placed in the central office of the latest and most approved type, the best instruments were rapidly introduced to take the place of those old and worn. All this took time and much money; the Erie Company, by their generous efforts, have or should have won the good will of the Northwest people. So many cares and much business made it necessary for the superintendent to rely upon the probity of well-known men in the business; but alas, for human frailty and the ingratitude of man, those most relied upon proved false to their trust, and made their moments golden opportunities indeed. The result was that just as the man who had worked hard and long to accomplish these much-desired improvements, saw his labor fructifying, then was his office taken from him, and those upon whom he had relied had the pleasure of causing his removal.

The company were very fortunate in securing for his successor so competent and genial a man as Mr. Black; a man of ripe experience, he brings with him the prestige of well-earned success in other fields. The Erie Company have done well by the Northwest under circumstances of peculiar hardship and trial, and the position they occupy to-day is one that has been earned by hard work, good management, and a conscientious desire to deal properly with their subscribers. If there has been an error it has always been to the advantage of the public, and never to the company.

If there is one subscriber who would go back to the old regime I have yet to learn it.

A.

SALEM, Nov. 14, 1884.

Tales of the Telegraph.

EXCITING EXPERIENCES OF OPERATORS ON THE FRONTIER.

Several old telegraph operators met here last night, and in the course of a long conversation, told some of their experiences on the frontier. One of them began by recalling the great bullion robbery at this place. It was at noon, and most of the depot and stage hands had gone across the yards to dinner. As the operator sat in the telegraph office alone two men presented themselves at his door and demanded admittance. Both had revolvers He jumped up and let them in, and they quickly bound and gagged him. Believing that he was safe, they disappeared, and he saw no more of them. As soon as they were out of sight he managed to get to his instrument, and by lying down on the table found that with one of his hands he could reach the key. It was difficult work, but by degrees he improved his position until finally he raised the Cheyenne office and communicated the fact that a robbery was in progress. The operator at that point kept him posted as to the proceedings there, and in a few minutes he was gratified to hear the intelligence ticked over the wires that the superintendent and a party of detectives were en route for Sidney on a special train. The distance was 102 miles, but the run was made so rapidly that the people of the town were hardly aware of the robbery before the train dashed in. The operator had by that time been released, and it was found that the thieves, who had been secreted under the depot, had come up through a hole in the floor made by removing a board. The bullion weighed about 500 pounds, and, as it was thought they could not have carried it far, a vigorous search was made near at hand. Before night the greater part of the gold was found in a hole under the depot, and the remainder was discovered in an adjoining coal shed, where it had been dropped. The thieves got away with

ONLY ABOUT $13,000 IN CURRENCY.

Another operator remarked that he was

the man who discovered the Ogalalla train robbery. He was in charge of the little office at Kearny. He had had a very stupid afternoon, and as the day was miserable without, he dozed more or less. He tried to read, but after it became necessary to light the lamps he found this occupation distasteful, and as no one came in he leaned forward, placing his arms on his table and his head upon them.

"I must have slept soundly for awhile," he said, "for I lost myself entirely for an hour or two, but presently I had an indistinct impression that some one was calling for assistance. In my dream it seemed to me that I could hear the cry 'Help! help!' and that I was powerless to render any assistance. Finally I sat bolt upright, with a nervous feeling as if something terrible had happened which I ought to have prevented. I rubbed my eyes, and looked around sleepily. The depot was empty. It was dark outside, and the rain was falling. I stepped to the door and looked out for a minute, but heard nothing. Then I went back to my desk, filled and lighted my pipe, and began to read. My eyes had just fallen on the page when my instrument sounded once or twice very feebly. I looked at it closely. It ticked again almost inaudibly. 'Somethings the matter,' thought I. I got up and leaned over the sounder and listened. I could just catch the faintest click, as if a child might have been playing with a key somewhere. While I listened I began to comprehend the nature of the message that was being sent. I could not catch all the letters, but I got enough, after listening to it a dozen times, to make out this much :

'OGALALLA, OGALALLA, HELP, HELP.'

It flashed upon me all at once. The overland train was being robbed, or had been robbed, I grabbed my key, and let everybody have it from Cheyenne to Omaha. There was some very lively telegraphing there for a time. They sent engines out from two or three points, and got to Ogalalla in time to scare the robbers off. You see I was a good deal further off than a dozen other operators, but somehow I was the first one that caught on. The way it happened was this : The robbers came into the depot at Ogalalla about an hour before train time, and bound and gagged the operator. After they got him fixed they sat around and waited. When the train drew up they left him, and he immediately got himself in a position where he could use the key a little. The boys who saw him say it is a mystery how he ever did it. His legs were tied twice, and his arms were pinioned behind him, so that it was almost impossible to move even the fingers. The fact that I could not catch two successive letters until I had heard the message ten or twelve times shows how faint the stroke was. It was the queerest experience of my life."

A third man said he had seen a good deal of service on the border, and had had a good many adventures, only one of which ever impressed him much. Down at Granada, on the Santa Fe road, when it was first opened, he had had a circus all one night with a party of robbers. The country was then a very dangerous one, and the management was in continual fear of desperadoes.

"I was in the office in the evening," he said, "getting ready to close up, when four or five hard men came in. They didn't say much at first, but seemed to be looking the ground over. We were always on the lookout for that kind of chaps, and as the machine was ticking, I pretended that somebody was asking me a question. I laughed a little, and, seizing the key, I broke in with 'Everybody—Don't stop the express at Granada to-night, whether signaled or not. Robbers here.' They eyed me sharply, but said nothing. The sounder kept up a merry click, and I leaned back in the chair. They fooled around for half an hour, and then one of them asked me what time the train was due. 'Eleven five,' I said. 'Well, we want it,' one of them replied. I told him that I would signal it. About 10.30 I got out the red lantern and lighted it. Just as I got it fixed two of them jumped up with revolvers in their hands and said they would save me the trouble. While one of them covered me with a pistol others tied me flat on my back to a settee.

I COULDN'T MOVE HEAD OR FOOT.

"After they got me there I began to think what sort of a scrape I had got myself in. The train would come presently, and go flying by, and then those cut-throats would murder me just for the fun of it. I had thought the thing all over when I heard a sharp whistle and a roar. The men ran out to the platform with masks on and revolvers in hand. One of them had the lantern, which he swung vigorously. In going out on the platform they had left the door open, so that I could see things pretty well. I began to hope that the train would stop, for I knew it contained men enough to do up that crowd if not taken too much by surprise. The roar came nearer and nearer, until at last I knew by the sound that they were not going to stop. With the whistle blowing at full blast, and the dust flying in clouds, she swept by like a stream of lightning. It was all up with me, I thought. The robbers dropped the lantern and began to swear. Then I could hear them talking, and pretty soon I made up my mind that the train had stopped down the road a way, and that they were watching it. Before long they took to their heels, mounted their horses and were gone. When the train men came up to the depot, all armed with Winchesters, I was the only occupant. They released me, and I told them what had happened. A couple of them stayed there with me, and the train went on. If any express ever came near being robbed without going through the mill than that one did, I'd like to know it."

All agreed that it was a close call, but the fourth speaker said he had a better story than any of them. There were no robbers in it. "I was one of the first men who worked a key in Virginia City, as you may know. One night a man came in, picked up a blank, wrote on it, and handing it to me, asked what the charge was. I read the message as follows: 'Killed Tom to-day. Will kill Jim to-morrow.' It was addressed to somebody in Philadelphia. I collected toll, and looked the fellow over, but I did not place much significance upon the wording of the message, and after a while forgot all about it. We used to get some awful queer messages. About one year later a nicely dressed stranger came in, and handing me the Philadelphia copy of that dispatch, asked me if it had been sent from there, and if I could tell him where the sender was. I told him that I remembered the circumstance, but I had not seen the man since. The next evening this man came in and handed me for transmission to Philadelphia a message reading : 'Found Charley. Will leave for home with him to-morrow.' As he was paying me I made some inquiry, because I was curious to know something about the case. The man said he would tell me the next day.

I NEVER SAW HIM AGAIN.

Two or three months later a man came in, and showing me that despatch asked me if I remembered sending it. I told him I did. 'Can you tell me where the man is who sent it ?' he said. I couldn't. Then he went out and I yelled to him, 'Say, hadn't you better tie a string to yourself ? I'm losing you fellows pretty fast.' This led to an explanation, and he told me all about it. It seems the three were brothers. The first one was a little flighty, and was continually running off to some out of the way corner of the globe. Only a few months before he appeared in Nevada, he had been in India. His brothers paid no attention at first to his crazy telegram, thinking it was only one of his looney jokes, but when several months had passed and they heard nothing of him they began to fear that he might have fallen into trouble, and it was decided that one of them should go after him. This was the second gentleman, and his failure to return brought out the third, under the apprehension that the others had been foully dealt with. Well, he was gone about a week, and began to believe that he gone up the spout too, when the first one came sneaking into my office and said : 'Say, if anybody comes around here looking for me, just tell them you don't where I am.' 'Where's your brother ?' said I. He looked at me nervously and said : 'He's up in the Comstock with me.' 'Where's your other brother ?' 'He's down East.' 'No he isn't,' I replied ; 'he's here in this town, and he's looking for you, and going to find you.' Just then the second one came in and said to the first : 'Come on, Charley, let's be going.' While I was questioning him in walked the other, and there was a great handshaking all around. The whole three of them seemed to enjoy the thing immensely. Well, I began to think those were the about the

CRAZIEST CRANKS I EVER SAW,

when the last one said kind of pityingly to me : 'It's all right, my boy. Those messages ain't just what they seem. A little cipher, you know. We've got silver up here till you can't rest, and we couldn't be telegraphing everything.' You see, I was young in those days, and when two of those lunatics came at different times with copies of messages, inquiring very particularly after the men who sent them, what was I to think ? No Philadelphian could come any such game on me now, I'll bet you. They all got rich, and when they came to sell out one of them made me a present of a silver brick worth about $25.

The last speaker was one who had no hair on his head, but who said, in response to an inquiry, that no scalping knife had ever taken it off. "It was just scared off," he exclaimed, "down towards old Julesburg. One day I was at my desk when the man up at Hooper's siding, ten or twelve miles away telegraphed down that he was surrounded by redskins, and that they were whetting their tomahawks on the wires. I thought it was a pretty good joke until he telegraphed that the station was in flames, and that a lot of Indians had set out for my place. Then I began to prick up my ears. There were not many of us there just then, and we were in no condition to fight Indians anyway. We threw up breastworks and got everybody who had a gun, a pistol, a club, or a knife to fall in. It was about sundown when we got all ready for them. While we were waiting nervously for the onslaught, one of the citizens, a saloon keeper, came riding up in mad haste and shouted that there were just 'millions of them coming.' 'You fellows are all as good as massacred now,' he said. 'There's only just one thing to do, and that is to telegraph up and down the line for help. Put it strong, now,' he said to me. 'Beg, implore, exhort them.' Well, I could rattle a key pretty well in those days, and I everlastingly begged for help. I was thoroughly scared, and I threw my whole soul in to the work. After about an hour of agony Cheyenne broke in with, 'Oh, turn yourself out, you big calf ! What's the matter with you ?' Tnis cooled me off a little, and I looked outside and saw the people going and coming as usual. They had put up a gorgeous joke on me, just because I was a telegraphic tenderfoot. My hair fell out soon after that, and it has never grown since."

The Nebraska Telephone Company paid its sixth quarterly cash dividend of two per cent. on October 31. The net earnings for the quarter just closed were at the rate of twelve per cent. per annum. Comments are unnecessary, the above speaks for itself, and shows that Messrs. Dickey and Drake have not been idle.

Esteve's column consists of six elements along with a separate recipient for the liquid (bichromate of potash). The cell of each element is of a rectangular form, and a lead pipe leads from the bottom of one to the upper part of the next. The first cell is double, connected with the closed reservoir for the fluid ; by the influx tube at the bottom end, and by a kind of safety-tube passing from the upper part of the reservoir, and which is closed by the liquid in the first element if the influx is too strong.—*La Nature.*

TELEGRAPHIC

.... The question of the employment of women in the telegraph service in large cities is always the order of the day, and it is announced that several will be appointed soon at Bourg and La Rochelle, in France.

.... The English Telegraph Administration has constructed four new lines between the English border and Glasgow, in view of the expected increase of traffic which is expected to follow the reduction in the tariff for telegrams.

.... We announced last week that the approaching telegraphic conference at St. Petersburg would probably discuss a project, emanating from the submarine cable companies, tending to introduce a higher tariff for dispatches in code words. The secretary of the administration of the cable companies in London has written to our contemporary, *The Electrician*, to contradict this rumor, and states that the companies have no intention of modifying the tariff for this sort of dispatches.—*La Lumiere Electrique.*

.... It is claimed that columns of lies are printed every year about the slowness of telegraph messenger boys. The youngsters do hurry. Coming down town yesterday morning I saw three of them, and they were all running. One of them had hooked an apple from a corner stand and was distancing a policeman. Another had heard a fire alarm while he was delivering a message, and was keeping up with the engine. The third was running down the manager of his office, to the great delight of an inquiring acquaintance.

.... The Western Union Telegraph office in Philadelphia is utilizing the bicycle in the delivery of messages very successfully. It has four bicycles which the messenger boys keep in motion all day and night. You never see more than two in the office at one time. The managers are delighted with them. They save boys, time and money. A messenger on one of these machines goes from the office of the telegraph company, opposite the treasury, to the boundary of the city, perhaps a mile and a half away, and back, inside a dozen minutes.

.... It appears that representatives of French commerce complain loudly of the telegraphic service in that country, and many petitions are being addressed to the Administration of Telegraphs asking for the more rapid transmission of dispatches. These requests are founded principally on the fact that in England a dispatch can be sent and a reply received in three hours, whilst in France more than six hours are often consumed in sending a dispatch and receiving a prepaid reply. Notwithstanding the establishment of subterranean lines, the transmission of dispatches certainly leaves very much to be desired.

.... Said a prominent telegrapher a few days ago, "Yes, there are a great many lady operators now in the telegraph business, and the number seems to be rapidly increasing. In many cases they show a remarkable aptitude for the work, and can conduct the business on the way, or smaller circuits as well, and sometimes better than a male operator.

"Some of them even attain the distinction of being called 'strickly first-class.' I could name quite a number of these right here in Boston, while in New York it is not an unusual thing to see a lady working a duplex or a quadruplex instrument, side by side with the expert who prides himself on his 'gilt-edged copy.'"

"Do many of them marry ?"

"Oh, no ; they are usually too intelligent for that. You see at the key they can earn a salary sufficient to support themselves in pretty fair style, and naturally enough become a little independent ; and you may have observed that independent women rarely enter matrimony, unless they see other money in the enterprise."

The New York and New Jersey Telephone Company Win the Suit Against the Domestic Telegraph and Telephone Company of Newark, N. J.

In the suit between the Domestic Telegraph and Telephone Company of Newark, New Jersey, complainant, and the Metropolitan Telephone and Telegraph Company and the New York and New Jersey Telephone Company, defendants, for the possession of the Newark telephone exchange property, the Domestic Company's contract having expired, vice-chancellor Van Fleet rendered the following opinion and decided case in favor of defendants on the 14th inst.:

"1. A Court of Equity may, in a proper case, decree the specific performance of a contract to renew a license.

"2. Specific performance of a contract will not be decreed unless the contract has actually been concluded; or if any material part of it still rests in treaty, and remains to be settled by further negotiation, equity will not interfere.

"3. No court has power to make a contract for persons *sui juris*, nor to compel them to agree with each other.

"4. Where an injunction is sought in aid of action for specific performance, if the complainant's case is strong enough to render it at all probable that the complainant may, on final hearing, be able to convince the court that he is entitled to relief, the court will, as a general rule, award the writ, but will refuse it in cases where it appears that the contract sought to be enforced has not yet been made, or, if made, that it is so incomplete or uncertain as to be unenforceable.

"On motion for an injunction heard on bill and affidavits and answer and affidavits, and order to show cause.

"Mr. Henry Young and Mr. Thomas N. McCarter for complainant.

"Mr. James M. C. Morrow and Mr. J. D. Bedle for defendants.

"VAN FLEET, V. C.

"The main object of the bill in this case is to procure a decree directing the specific performance of a contract. The complainant asks for an injunction pending the suit, a anxiliary to the principal relief sought; in other words, to preserve to it the possession and use of certain property, which it is now unquestionably entitled to hold and use if it shall be made to appear on final hearing that the complainant is entitled to the relief it seeks. The question now before the court is whether an injunction shall be granted or not.

"The contract on which the complainant rests its right to relief was made by the complainant with the Bell Telephone Company of New York, and bears date August 6, 1879; prior to the date last named the Bell Telephone Company of New York had, by force of a license granted to it by the Bell Telephone Company of Boston, acquired an exclusive right to use, and of licensing others to use, the patented instrument known as the Bell telephone, in all the territory lying within a radius of thirty-three miles from the New York City Hall in all directions, and also in all the territory of Long Island, in the State of New York, and of Monmouth County, in the State of New Jersey, but excluding any part of the State of Connecticut lying within such boundaries. The contract is lengthy, and contains a great many provisions having no connection with the complainant's present claim. Reference will only be made to such parts of it as are necessary to show its general character, and to the particular provision on which the complainant's action is founded.

"It provides, in the first place, that the Bell Telephone Company of New York shall furnish to the complainant, in such quantities as may be required, Bell telephones, to be used by the complainant in establishing a system of telephonic inter-communication within the city of Newark, in the county of Essex, and the townships of Harrison and Kearney, in the county of Hudson, but not elsewhere. The complainant binds itself to pay an annual royalty on each telephone delivered to it, to prosecute the business of introducing telephones diligently; not to use any other telephones than those furnished by the Bell Telephone Company of New York, and not to permit any connection to be made between its lines and any other lines except such as may be owned and controlled by the Bell Telephone Company of New York. The Bell Telephone Company of New York reserves to itself the exclusive right of establishing telephonic communication between the complainant's district and other districts, and to regulate the charges on messages passing from one district into another. It also agrees that, so long as the complainant keeps its contract, it will not authorize the use of the Bell telephone; or any other telephone, by any other person, within the complainant's district, so as to interfere in any manner with the complainant's business. The contract also provides that a failure by the complainant to prosecute the business of introducing telephones diligently, or a violation by the complainant of its covenant not to permit a connection to be made between its lines and any other lines except such as may be owned or controlled by the Bell Telephone Company, shall, at the option of the Bell Telephone Company of New York, operate to end the contract and confer upon the Bell Telephone Company of New York a right to take possession of the complainant's district and carry on business therein as though no contract had been made. By the ninth paragraph it is agreed that the contract shall remain in force for the period of five years, commencing on the first day of September, A.D. 1879, and terminating on the last day of August, A.D. 1884; at which latter date the complainant promises that it will deliver, or cause to be delivered, to the Bell Telephone Company of New York, or to its agents, all telephones theretofore delivered to it and not previously returned. The eleventh paragraph is the one on which the complainant grounds its right of action. It is as follows:

"'If, at the expiration of the above period of five years, the party of the first part shall not desire to conduct the business of telephonic district exchange directly within said district of the party of the second part, or of merging said district into some other district, but shall, on the contrary, desire to have such business conducted for it, then and in such case the party of the second part shall have the first right of acquiring the license, or agency, to conduct such business at such rate or rental and upon such terms as may then be fixed and determined by the party of the first part.'

"On the first day of July, 1880, the Bell Telephone Company of New York sold and formally assigned its telephone lines and business, and also all its rights under the contract with the complainant, to the Metropolitan Telephone and Telegraph Company, one of the defendants to this suit. The complainant assented to this transfer, and has since then fully recognized the Metropolitan Telephone and Telegraph Company as the successor of the Bell Telephone Company of New York, and as standing in the place of the latter corporation under the contract of August 6, 1879, both in respect to the rights and obligations created by that contract. By several subsequent transfers the defendant, the New York and New Jersey Telephone Company, has become invested with whatever rights, in the complainant's district, it was within the power of the Metropolitan Telephone and Telegraph Company to pass or transfer as against the complainant. The New York and New Jersey Telephone Company, as well as its predecessors in right, all took with full notice of the complainant's rights. In the license granted by the Metropolitan Telephone and Telegraph Company to the New Jersey Telephone Company, now merged in and constituting part of the New York and New Jersey Telephone Company, it is expressly stated that the privilege thereby given shall not embrace the complainant's territory unless the complainant shall be able to compel an extension or renewal of its license. The grant, it thus appears, is merely provisional or conditional. It is to have effect, as against the complainant, in case the complainant cannot compel a renewal, but not if it can. The defendants now before the court, as well as the corporations in whose rights they stand, all acquired whatever rights they have with full notice, not only of the complainant's contract, but of the claim made by the complainant for a renewal of its license. The case stands, therefore, in all substantial respects and for all purposes of justice, just exactly as it would have stood if the original contracting parties were now, instead of the present parties, the litigants before the court. If the complainant, on the facts now before the court, would be entitled to relief against the Bell Telephone Company of New York, were it the only party defendant here, I take it to be entirely clear that it is entitled to the same measure of relief against the defendants now here.

"In April 1884, the complainant applied to the Metropolitan Telephone and Telegraph Company for a renewal of its license or a new license. Its application was refused. Subsequently the bill in this case was filed to compel the Metropolitan Telephone and Telegraph Company to specifically perform the contract of August 6, 1879, by granting to the complainant a new license 'upon such terms as may be determined by the court.' As ancillary to such relief, the complainant asks, that, pending the litigation, an injunction shall issue restraining the defendants from removing the telephones now in its possession, also from interrupting communication between the complainant's district and other districts, and also from interfering with complainant's business in its district.

"The power of the Court to give complainant the relief it asks is unquestionable. Though courts of equity do not, as a general rule, exercise as liberal jurisdiction over contracts of the kind which the complainant seeks to have enforced as they do over contracts relating to land, yet their power to decree the specific performance of such contracts, in a proper case, as for example, where the complaint has not a clear, complete and adequate remedy at law or where some other ingredient of equity is mixed with the transaction, is now firmly established. Cutting *vs.* Dana, 10 C. E. Gr., 265.

"The complainant's whole equity rests in the allegation that it is entitled, by the terms of the contracts, to a renewal of its license. But upon what terms? The complainant says: 'Upon such terms as may be determined by the Court.' Courts of equity may compel the specific performance of a contract which the parties have agreed upon, and which is sufficiently certain and definite in its terms to enable the Court to see what they meant, but it is entirely beyond the power of any judicial tribunal to make a contract for litigants, or compel them to make a contract with each other. The principle which must govern the decision of this case is free from all doubt. No court has power to make a contract for persons *sui juris*. No specific performance of a contract can be decreed in equity unless the contract be actually concluded and be certain in all its parts. If the matter still rests in treaty, or if the agreement, in any material particular, be uncertain or undefined, equity will not interfere. Specific performance will not be decreed unless it is shown that a contract has been concluded. The bargain must have been completely determined between the parties and its terms definitely ascertained. So long as negotiations are pending over matters relating to the contract and which the parties regard as material to it, and until they are settled and their minds meet upon them, it is not a contract, although as to some matters they may be agreed.

"The contract, it will be observed, does not contain an unconditional covenant of renewal or indeed, a covenant to renew at all, but it merely provides, that on the expiration of the term of the first license, and in a certain contingency, the complainant shall have the first right of acquiring a license. The covenant is not that the licensor shall renew the complainant's license, nor that the complainant shall, if it desires, have a new license, but merely that it shall have a first or preferential right to acquire a license. This, it is plain, is not equivalent to a covenant to renew. Under a covenant to renew, the rights of the license are fixed and certain; they are superior to those of any other person, and determinate; no other applicant can compete with him, nor can the terms offered by any other applicant be contrasted with those offered by him. The licensor must renew, if the licensee so elects, whether he is willing to or not. But under the language of this covenant the thing promised to the covenantee, is not a renewal of its license, but merely the first right or chance to make a bargain for a license. Before any right can arise, under such a stipulation it is clear, that it must be shown that a bargain has been made. Construed for the complainant as favorably as its language will warrant, it is manifest, that all that the covenant gives the complainant is the first right to make a bargain for a new license. Such a covenant cannot be enforced in equity. But let us suppose that the contract gave the complainant an absolute right of renewal, without specifying terms, then the question would arise, for what period, and on what terms should the renewal be granted? These matters, by the plain letter of the contract, are left entirely and absolutely to the will of the licensor, the language of the contract being, that the complainant 'shall have the first right for acquiring the license or agency, to conduct such business, at such rate or rental, and upon such terms as may then be fixed and determined by the party of the first part.' It would be difficult, I think, to find language, expressing with more perspicuity than this does, an intention on the part of the licensor to reserve to itself an absolute and unqualified right to dictate the terms of the contract. There is not only an entire absence of specification of the terms on which the new license shall be granted, but an express stipulation that the licensor shall have a right to exercise an uncontrolled will in fixing the terms. Under such a stipulation, the licensor is left as free in every respect as it would be if no previous contract relations had existed between the parties, and the complainant now, for the first time, applied for a license. This court cannot compel a person to make a contract, the terms of which have not been agreed upon, though he may have covenanted to do so. If the licensor in this case had made an unconditional promise to renew for a definite period, but upon terms to be afterwards agreed upon, or fixed by the licensor, the contract would be so incomplete and defective that it would be incapable of enforcement.

"Nor is the complainant's case at all strengthened by the fact that since its contract was made the corporation now having the right to grant a license for the complainants' territory has agreed with the corporation owning the Bell telephone patents that it will not charge its licensees, as royalty or rental for telephones, in excess of a specified sum. The complainant is not a party to that contract, and consequently acquired no rights under it, and did not become bound by its terms. If it is broken, the complainant will sustain no injury, at least, none that the law can redress. The other contracting party is the only person who can suffer a legal injury by its breach, or ask legal or equitable redress for its violation. But, in addition, it is not pretended that that contract fixes or defines the period for which licenses shall be granted. The corporation to which the complainant must go for a renewal of its license is absolutely unbound, either to the complainant or to any other person, as to the period the new license shall run, and is at liberty to fix a day or a week, just as it may will.

"The fatal infirmity of the complainant's case is not that its contract is uncertain or incomplete, but that it has no contract. Its licensor has never agreed that it would renew its license, and, until such an agreement is made, it is impossible for this court, or any other, to decree specific performance. There can be no doubt, that in a certain class of cases, courts of equity will decree the specific performance of contracts which are incomplete or uncertain, in a material particula, but such jurisdiction is never exercised, except in cases where the contract itself provides a method or standard by which it may be completed, or its uncertainty rendered certain. To illustrate: A contract for the sale of land at a price to be agreed upon by the parties, will never be enforced in equity, for the reason, that a further bargain must be made by the parties before the court can decree what the vender shall receive for his land. But where the parties have agreed that the land shall be conveyed, not at a price to be agreed upon by themselves, but at a fair price, or at a fair valuation, there, the parties having fixed a standard a standard or measure of value, without having designated any particular method for ascertainit g the price, the court may, without making a contract, ascertain the price according to the standard fixed by the contract, and enforce the contract. But this is the extreme limit to which any court has ever gone.

"The complainant contends that its case falls directly within the principle established by these cases. Its contention is this: that the contract on which its action is founded provides a method for settling the terms on which its license shall be renewed, and inasmuch as that is the fact, an injunction should issue to preserve to it its business and the telephones now in its possession, until the method provided by the contract for settling the terms shall have been tried and proved ineffectual. The sixteenth paragraph of the contract declares, that in the event of disagreement between the parties, arising out of the cotract, or any clause thereof, such matter of disagreement, unless it can be satisfactorily adjusted, shall be determined by arbitration. By this clause, it is insisted, that the partles have agreed, that in case they cannot agree upon the terms of the new license, they shall be settled by arbitration. It is impossible for me to read the contract so as to give this clause any such effect. The clause under consideration simply provides for the reconciliation of differences or disagreements arising out of matters upon which the parties have already agreed, or for the settlement of matters upon which each party has a right to form a judgment, or to exercise a will or choice. There can be no disagreement between the parties about the terms on which the new license shall be granted. They are to be such as shall be fixed and determined by the licensor. They are not subject of agreement, but of dictation. They need not be fair, or reasonable, or just; they may even be such as the licensor knows the licensee cannot accept. In making terms, the licensor has reserved to itself, in clear terms, absolute freedom, and in that respect, it stands as completely unshackled as though no previous contract relations had existed between the parties. It is manifest, I think, that neither of the parties ever supposed that the terms on which the new license should be granted, were in any event, or under any circumstances, to be settled by arbitration.

"This is not a case in my judgment, in which an injunction should be granted. It is true, that in cases of this kind, where an injunction is sought in aid of an action for specific performance, that the court will, as a general rule, if the complainant's case is strong enough to render it at all probable, that he may, on final hearing, be able to convince the court that he is entitled to relief, to award an injunction; but in cases where there is no doubt, where it is clear that the contract sought to be enforced has not yet been made, or if it has been made, that it is so incomplete or uncertain that it cannot be enforced, an injunction must be denied, for the very obvious reason that the complainant has no equity which entitles him to a writ.

"The order to show cause must be discharged with costs."

The New York and New Jersey Telephone Company, having won the suit, took possession and commenced business in Newark on Monday last.

New Novelties in Electric Lighting.

It was recently our pleasure to call at the offices of Messrs. G. W. Foster & Company, of 21 Park Row, and to make the acquaintance of some really surprising evidences of the advances that are now daily observable in the application of electrical science to the requirements, not so much of the public as a whole, but as an aggregate of individuals to whom, up to this moment, electricity, as a cheap domestic illuminator, has been an impossibility. A strong, portable light is a necessity to many persons, from the mechanic to the student; and, it will be seen from an examination of some of Mr. Foster's improvements, how the nece-sity has been provided for.

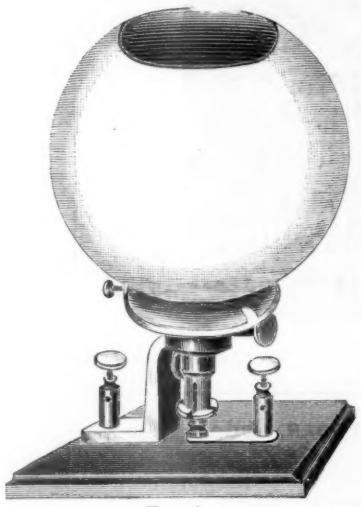

FIG. 1.

The accompanying illustration represents Mr. Foster's new arc lamp; a novel apparatus requiring less space than any of its class that we have seen. The size of the original of our illustration is about 6½ inches high, by 4¼ inches square at the base. Including carbons and globe, it weighs only one pound, and yet is capable of giving a 100 candle-power light; or, a one candle-power light, as it may be required without either increasing or decreasing the size. The regulation is effected simply by changing the carbons, and reducing or increasing the amount of the current passed through them until the desired intensity of light is arrived at.

It will be seen at a glance how this lamp will supply a long felt want in lighting small rooms and corners where the arc lamps heretofore manufactured would be useless, even if like the one under consideration they were within the pecuniary reach of all; for a dozen of these arcs may be bought for less than one of the old style would cost.

With regard to the practical advantages of this invention we may say that it is particularly adapted to photographic purposes for focusisng the light. Still another is readily seen that it is a really portable arc lamp, it may be carried from one room to another, connected and disconnected from the circuit by means of a flexible cord or other metallic connection, used in or out of doors, horizontally, perpendicularly, or at any angle that may be desired. Under all circumstances its performance may be relied upon. It may be placed in circuit with any other lamp, arc or incandescent, and successfully operated at very slight expense with primary or storage batteries, 16 cells only being required to produce sufficient light to illuminate a fair-sized room.

Another of his latest developments is his new incandescent lamp, for domestic and other purposes, as shown in our second illustration. This lamp, which is 5½ inches high and weighs less than 4 ounces, requires no dynamo or steam power, but is operated by a simple chemical battery; in fact, the ordinary blue stone or telegraph battery is sufficient for the usual time of burning gas or other lights from day to day. The entire apparatus, being portable, may be used in or out of doors without extinguishing or impairing the quality of the light. Four one-quart jars of "Bunsen," or other batteries of equal electromotive force, will, it is claimed, illuminate this lamp beautifully, at an expense of from 25 cents to 50 cents per week for chemicals. Three cells of "Planté" Storage Battery, such as are now made by Mr. Foster, 1¼×3¼ ×6 inches in size, will illuminate it for eight consecutive hours. The primary battery to store the same may be two one-quart jars of "Bunsen" or other chemical battery of high electro-motive force; or they may be stored by a dynamo current.

Telegraph operators and battery men will find this lamp to be very convenient for their use, particularly so in searching for breaks and obstructions in the circuit, as it may be thrust in between wires, batteries, and instruments, and into small places such as could not be reached by any other style of light. Plumbers, gas-fitters, and all kinds of machinists will find it to be a marvel of assistance to them in examining complicated machinery, water, steam, gas, and other pipes in buildings, thus, in many cases saving the trouble and expense of tearing up floors and otherwise demolishing whatever prevents the ready access of ordinary light. Wells, cisterns, tanks and vats, filled with water or transparent liquid may be examined to their utmost depths in safety by lowering the light on a leaded line from the top or opening. In fact there are many purposes yet untried to which it may be successfully applied.

Of more direct and special application is the lamp represented in our third illustration, which clearly indicates one of the many designs of Mr. Foster's Doctors' and Dentists' lamp, for illuminating the teeth, mouth, throat and ear to discover the condition of those organs, and for use in the speculum in examination for diseases. The engraving shows the natural size of the lamp, which weighs complete two-thirds of an ounce, and requires but two cells of primary or storage battery (weighing about five pounds) to illuminate it brightly.

One cannot fail to see the advantage of a direct light as compared with that reflected from a mirror for surgical or dental examinations. It having been the aim of Mr. Foster, the inventor of this apparatus, to produce a light superior in quality to any other, he has constructed the lamp of a suitable resistance to ensure a clear, white light, rather than one of yellow or red cast, in order that the observer may not be deceived as to the inflamed condition of the parts examined, this point being of the utmost importance to the medical profession in all its branches.

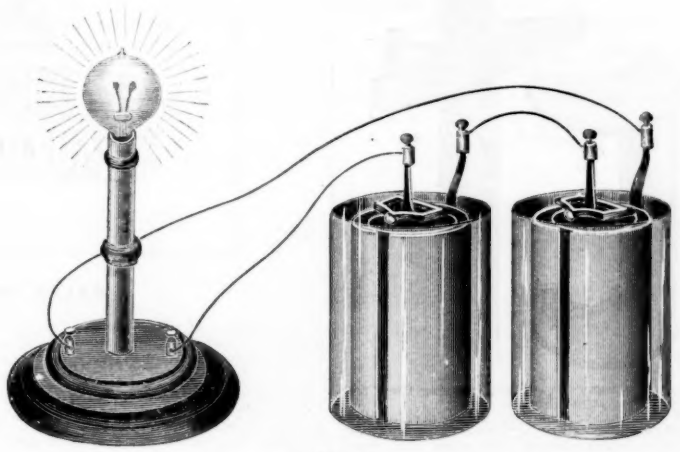

FIG. 2.

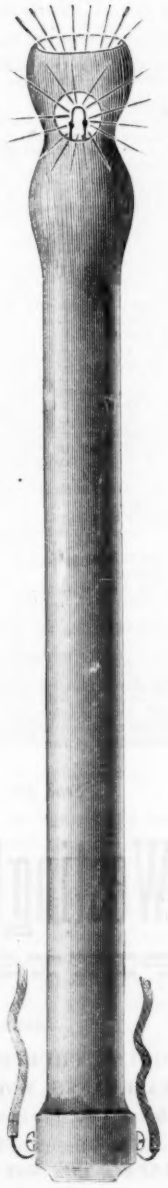

FIG. 3.

Flexible cords of any desired length connect the lamp with the battery, and a small two point switch is used to produce and exterminate the light. The carbon filaments last from 100 to 500 hours, and may be renewed at any time at a small cost. The globe of the lamp is protected by a hood or covering, which prevents it from burning the parts with which it may come in contact. This enables the operator to insert the light into the mouth, for example, far enough to brilliantly illuminate the throat, a most useful effect not to be obtained in such excellence by any sytsem of mirror reflection yet employed.

Outside the technical uses of the instrument, physicians will also find that, in making night calls, reading memoranda in their carriages, searching for house numbers, climbing stairs, and passing through dark passages, it will prove itself of great practical value.

Mr. Foster has organized a company, entitled the "Foster Electric Light Company," for the purpose of manufacturing electric lights, primary and storage batteries, dynamos, telegraph instruments, burglar alarms, medical batteries, motors, etc., etc.

From the details which we have herein laid before our readers it may be gathered that Mr. Foster, through his company, is not only prepared to offer a great many actual novelties in the matter of electric lighting, but in what he has already done he has shown a just appreciation of the practically limitless field in which electricity in all its forms may be held subservient to the daily growing requirements of civilized life.

—— The old Theater Royal, at Liverpool, is to be transformed into a circus, and will be lit, both inside and out, by the electric light.

ELECTRIC LIGHT NEWS

—— Some of the sugar-houses and plantations in Havana are to be lit with the electric light. They will generally use the Weston system.

—— The works of Messrs. Essande Bros., at Nogent-les-Vierges, near Creil, are now lit by the electric light. The system used is that of Jablochkoff. The installation comprises a self-exciting alternating-current Gramme machine and six candles.

—— A committee, composed of the principal electricians of England, is about to be formed in London to secure the repeal of the legislation of 1882 on the electric light, which has caused so many complaints and discontent on the part of all electric light enterprises throughout that country.

—— The annual report of the lighthouse board contains full details of the work done during the fiscal year. There were at the end of the year 722 lights on the United States coasts and 1,049 movable river lights in operation. The electric light at Hell Gate, New York harbor, established last month, is referred to as "the only one used in the lighthouse operations in any country for illuminating as by artificial daylight a narrow channel."

—— The galvanometer of Deprez d'Arsonval has been applied to the measurement of the current which is necessary for the illumination of a Geissler tube. The galvanometer was regulated to give a scale division for each hundredth-millionth of an ampere. At the moment of illumination the current was 3,50 micro-amperes; it was gradnally reduced until there was a sudden extinction at 150 micro-amperes. The experiment points to great advantages which may result from the use of the galvanometer in measurements of small intensities.

—— The Electric Lighting Company of Geneva has inaugurated, during the month of September, a system of electric lighting from a central station, organized, for the present, on a very restricted scale. The electricity is produced by an Edison machine capable of feeding about 70 lamps of 16 candle-power each. This machine is driven by a turbine of the Escher, Wyss & Company model, operated by a branch from the city water-mains. The main conductors are supported on posts for a portion of the distance traversed by the circuit, and for the remainder they are attached to the walls of houses.

The places lighted so far are the Great Quay, the Cafe du Nord, the Cafe de la Couronne, and some stores. The Society is daily in receipt of new subscriptions, which it cannot at this moment fill; but it is now in negotiation with the municipal authorities, whose permission is necessary for a further extension of the system, which, so far, has been perfectly successful.

—— The committee of the electrical section of the Antwerp Exhibition is actively occupied with the subject of the electrical illumination of the exhibition building; several offers have already been made, but nothing is as yet definitely decided. The expense will be, in fact, very considerable, as the enclosed space includes more than 22 hectares, of which 78,000 square meters are covered. For a suitable installation 1,500 to 1,800 horse-power would be required, perhaps even 2,000. A special committee will be appointed for electrical experiments in the exhibition, and the international committee will be divided into four sub-committees, which will respectively have charge of,

1st. Dynamic experiments.

2d. Apparatus producing or requiring heavy currents; dynamo-machines, primary batteries and accumulators.

3d. Conductors, supports, etc.

4th., and last. Apparatus producing or requiring feeble currents, such as telegraph, telephones, etc.

The Belgian Commission is composed of the members of the Bureau of the Electrical Section.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING NOVEMBER 11, 1884.

307,759—Electric cigar lighter; Walter Glass, New York, N. Y., assignor to Sigmund Bergmann and Edward H. Johnson, both of same place.

307,760 Railroad signal system; William Hadden, Brooklyn, N.Y., and Henry Van Hoevenbergh, Elizabeth, N.J.; said Van Hoevenbergh assignor to said Hadden.

307,769 Electric arc lamp; Edwin J. Houston, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut.

307,777 Electro magnet; William A. Leggo, New York. N. Y.

307,791 Electrical conductor for railways; Alex. M. Neeper, Pittsburgh, Pa.

307,808 Electric arc lamp; Auguste Serraillier, South Kensington, County of Middlesex, London, England.

307,810 Apparatus for regulating and distributing electric currents; Joseph J. Skinner, Newtonville, Mass.

307,818 Automatic cut-out for electric apparatus; E. Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

307,819 Cut-out for electric lamps; E. Thomson, Lynn, Mass., assignor to the Thomson-Houston electric Company, of Connecticut.

307,836 Telegraph key; Christian Borchers, New York, N. Y.

307,841 Printing telegraph; Gilbert A. Cassagnes, Paris, France.

307,866 Electro-magnetic annunciator; Augustus C. Palmer, Utica, N. Y.

307,872 Underground conduit for electric wires; W. J. Ryckman, Brooklyn, N. Y., assignor of one-half to Benjamin Lewis, same place.

307,879 Combined gas and electric light fixture; Luther Stieringer, New York, N. Y.

307,884 Apparatus for operating tools by electricity; Charles J. Van Depoele, Chicago, Ill.

307,888 Apparatus for maintaining electrical connections; Charles W. Williams, Cave City, Ky., George S. Barnum, Atlanta, Ga., and Edward B. Ives, New York, N. Y.

307,916 Insulator; John S. Cleveland and George Kent, Norridgewock, Me.

307,945 Battery; William S. Hogg, U. S. Navy.

307,984 Communicating to and from moving vehicles by electricity; Lucius J. Phelps, New York, N. Y.

308,019 Anti-induction device for telephonic circuits; Henry Van Hoevenbergh, Elizabeth, N. J.

308,020 Telephone circuit; Henry Van Hoevenbergh, Elizabeth, N. J.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

Any of our readers having copies of the old REVIEW of the TELEGRAPH AND TELEPHONE, dated March 15th, 1882 (No. 3), not specially needed by them, will confer a great favor upon us by sending them to this office, for which we will remit twenty-five cents per copy. ELECTRICAL REVIEW PUBLISHING CO., Box 3,329. 23 Park Row, New York.

Neatly-bound volumes (half-yearly) of the ELECTRICAL REVIEW will be sent, postage prepaid, on receipt of $3; also the latest improved self-binders for the ELECTRICAL REVIEW, or any other electrical or scientific journal published in this country, for $1. ELECTRICAL REVIEW PUBLISHING CO., 23 Park Row, New York. N Y.

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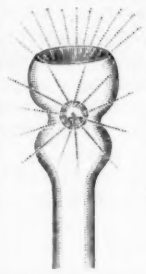

Foster's "Incandescent" 4, 8 and 16 Candle Power Lamps, $5.

Foster's "Arc" Lamps 25 to 100 Candle Power, $5.

Foster's Doctors and Dentists' Lamps for examining the Mouth, Teeth, Throat and Ear, and for use in the Speculum, including Battery, Silk Covered Flexible Cords, Battery Case and Connections, $15.

Electric Motors, $2, and upwards. Burglar Alarms, $1 Medical Batteries, $2, and upwards. Carbons, $7.50 per 100. Electric Tops, 75c. 6 Drop Annuciators, $6. Storage Batteries, Dynamos, and Arc Lamps of any size, and other electric goods. Agents wanted. Estimates furnished and circulars sent on application. Address

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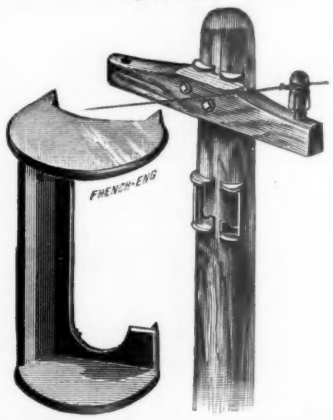
Especially adapted for Telephone and Electric Light Poles.



Among the many advantages in using the Cross Arm Holder are the following:

It does away with cutting gains in poles, as is done at present; and thereby weakening the wood.

It gives a larger bearing to the cross arm. On a six inch pole it gives fully eight inches, and greater bearings on poles of larger dimensions.

It is easily adapted to standing poles.

It prevents decay to the poles and cross arms at the gain.

A cross arm with this holder is easily raised or lowered upon the pole without disconnecting wires from the insulator by merely withdrawing the screws.

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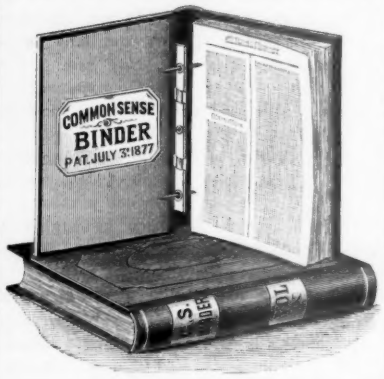

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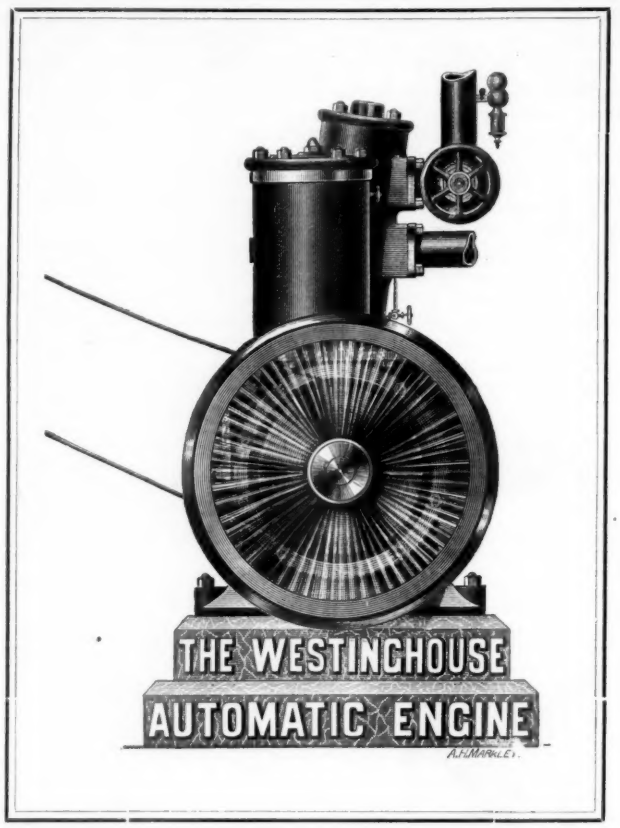

SALES FOR OCTOBER, 1884.

O. F. B. Barber, Flouring Mill	Golden, Col.	75	H. P.
Kenyon & Newton, Planing Mill	Brooklyn, L. I.	75	"
U. S. Illuminating Company	Charleston, S. C	60	"
" " " (2d order)	" "	60	"
" " " (3d order)	" "	60	"
" " " (4th order)	" "	60	"
" " " (5th order)	" "	60	"
Toledo Electric Company	Toledo, Ohio	60	"
Thomson-Houston Electric Light Company	Quincy, Ill.	60	"
" " " " " (2d order)	" "	60	"
Thomson-Houston Electric Light Company	Philadelphia, Pa.	50	"
Consumers Gas, Fuel and Light Company	Chicago, Ill.	45	"
J. M. Gusky, Electric Light	Pittsburgh, Pa.	45	"
Himebaugh & Merriam, Electric Light	Omaha, Neb.	45	"
Chas. Aubert, Irrigation	Port Allen, La.	40	"
Susquehanna Water Power and Paper Company	Conowingo, Md	35	"
C. H. Klemar, Wooden Mill	Faribault, Minn.	35	"
The "Battle House," Electric Light	Mobile, Ala.	35	"
Hastings Electric Light Company	Hastings, Neb.	35	"
" " " " " (2d order)	" "	35	"
O. W. Butts, Packing House	Kansas City, Mo.	35	"
Morris But & Company	" "	35	"
Lowell M. Palmer, Paper Mill	Brooklyn, L. I.	35	"
Smith & James, Saw and Flour Mill	Columbia, Mo.	35	"
E. B. Ward, Ginning	Plainview, N. C.	30	"
W. W. Pugh, Draining	Home Place, La.	30	"
L. Lepayre, Irrigation	Bayou Goula, La.	30	"
Baltimore and Ohio Rail Road Shops	Columbus, Ohio.	25	"
G. W. Young, Ginning	Honey Grove, Texas	25	"
Harvey Miller, Nickel Plater	Cincinnati, Ohio	25	"
Timothy Vinton, Paper Mill	Brattleboro, Vt.	25	"
Lawrence Machine Shop (2d order)	Lawrence, Mass.	25	"
Lombard, Ayres & Company, Saw Mill (3d order)	Mobile, Ala.	20	"
H. W. Jones, Ginning	Row Landing, La.	20	"
Kingsland, Jackson & Company, Machinists	Chicago, Ill.	15	"
J. Christman, Elevator	Stewartsville, Mo	15	"
Bell Brothers, Flour Mill	Osage, Iowa	15	"
Fred Hanson	Eau Claire Wis.	15	"
G. B. Shaw, Elevator	Kansas City, Mo.	15	"
" " (2d order)	" "	15	"
Stoutz & Company, Planing Mill	Mobile, Ala.	15	"
T. G Cansler, Ginning	Itaska, Texas	15	"
H. Hartzmann	Ash Hill, Mo.	15	"
J. Greenlaw, Ginning	Calvert, Texas	15	"
Shutte & Company, Planing Mill	Pittsburgh, Pa.	15	"
A. M. Good & Brothers, Saw Mill	Waynesboro, Pa.	15	"
Hermann Fletcher	Louisville, Ky.	12	"
Worcester Gas Light Company	Worcester, Mass.	8	"
Anderson & Barr	Philadelphia, Pa.	8	"
Thomson-Houston Electric Light Company (3d order)	St. Louis, Mo.	8	"
W. C. Kerr & Company, Yacht Engine	New York.	8	"
" " " (2d order)	" "	8	"
H. L. Howe, Fan Blower	Canandaigua, N. Y.	8	"
Ed. Lehda, Tea Store	New Orleans, La.	4	"
R. H. Nevins, Ice Factory	Mayo, Fla.	4	"
F. Plumb, Ditching (11th order)	Streator, Ill.	4	"
" " (12th order)	" "	4	"
Steamer "Big Sandy," Electric Light	Cincinnati, Ohio	4	"
Total, Fifty-eight Engines		1,685	H. P.

Besides the above, nineteen engines were purchased by our various agents for general stock, making a total sale of seventy-seven for the month. We are now enlarging our Works to a capacity of 100 Engines per month, or our Engines per working day.

In view of the universal stagnation of Trade, we would candidly ask if the above list is not conclusive as to the standing of the Westinghouse Automatic Engine?

Send for Illustrated Circular and Reference List.

The Westinghouse Machine Company,

PITTSBURGH, PA.

SALES DEPARTMENT CONDUCTED BY

WESTINGHOUSE, CHURCH, KERR & CO., 17 Cortlandt St., New York.
FAIRBANKS, MORSE & CO., Chicago, Cincinnati, Cleveland, Louisville and St. Paul.
FAIRBANKS & CO., St. Louis, Indianapolis and Denver.
PARKE & LACY, San Francisco and Portland, Oregon.
PARKE, LACY & CO., Salt Lake City, Utah.
IMRAY, HIRSCH & KAEPPEL, Sydney and Melbourne, Australia.